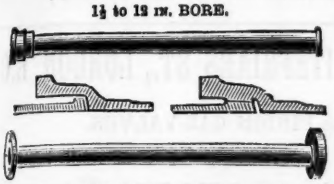
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVIII. No. 1484.] LONDON, OCTOBER 20, 1891. [43RD YEAR. Price 6d.

GAS AND WATER PIPES.

1½ to 12 IN. BORE.



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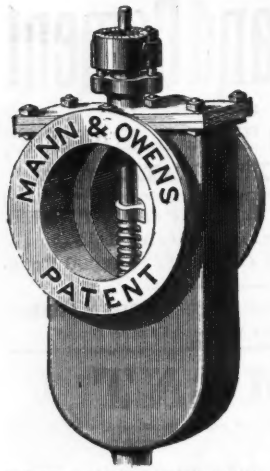
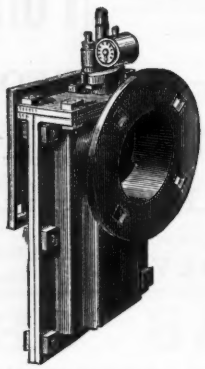


VALVE to OPEN DOWNWARDS.



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for Regulating the Seal
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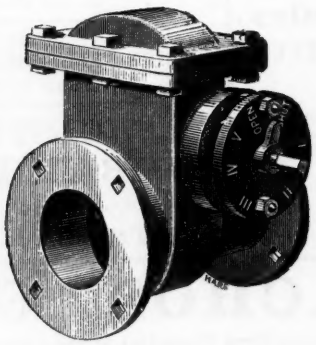

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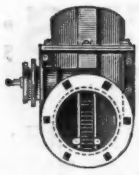

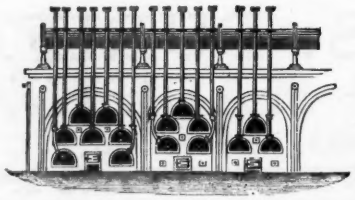

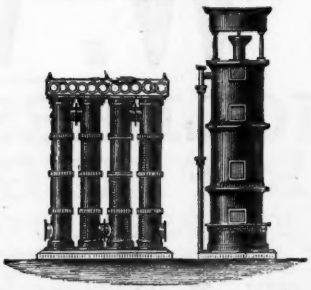

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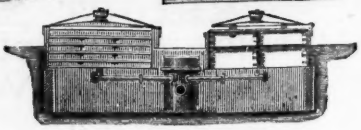

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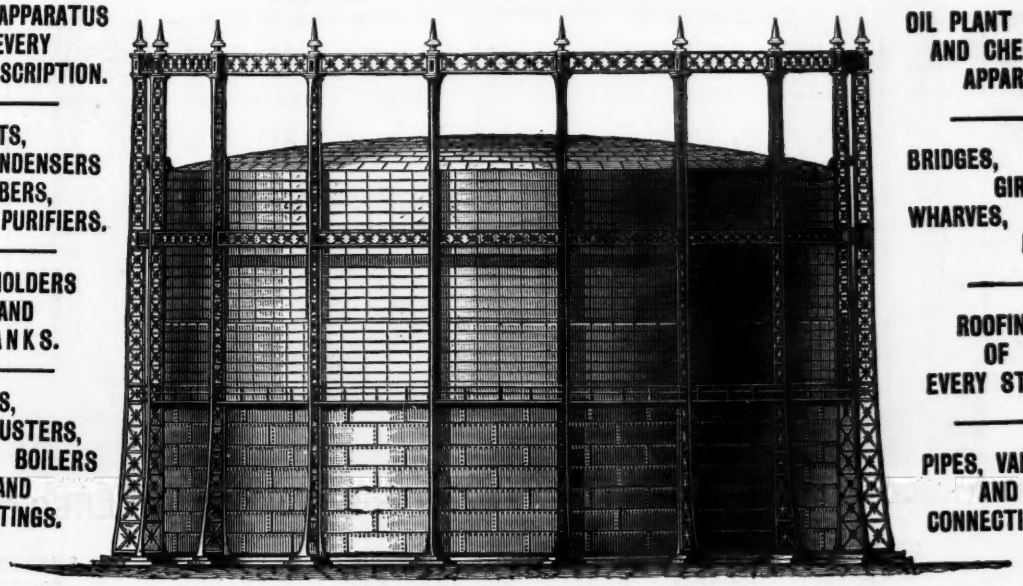

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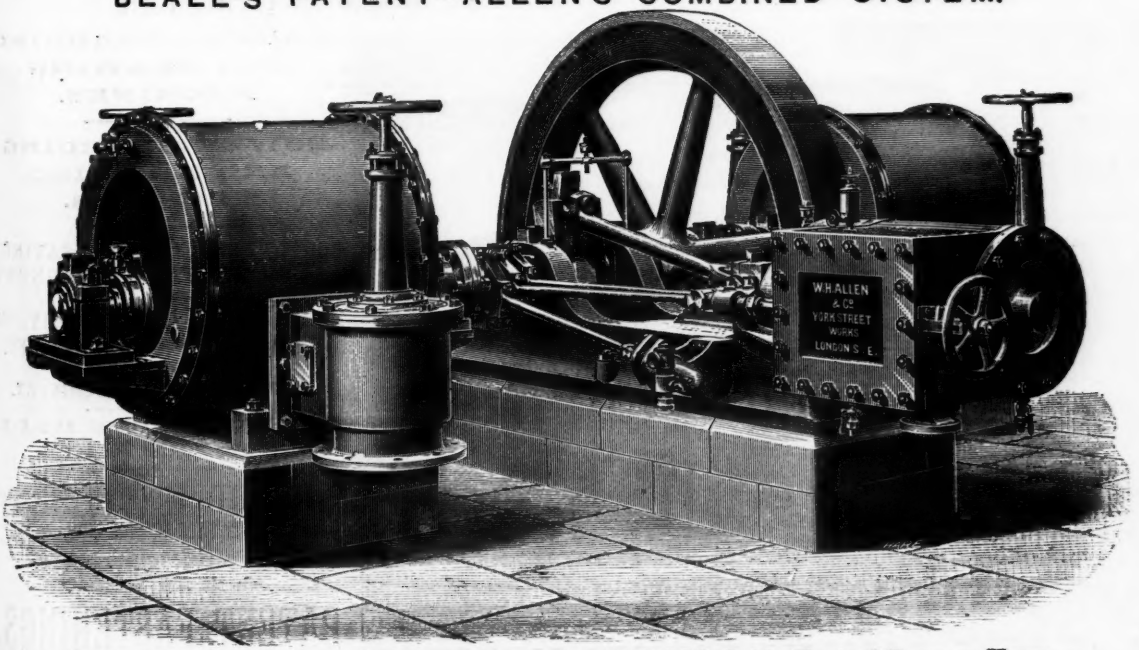

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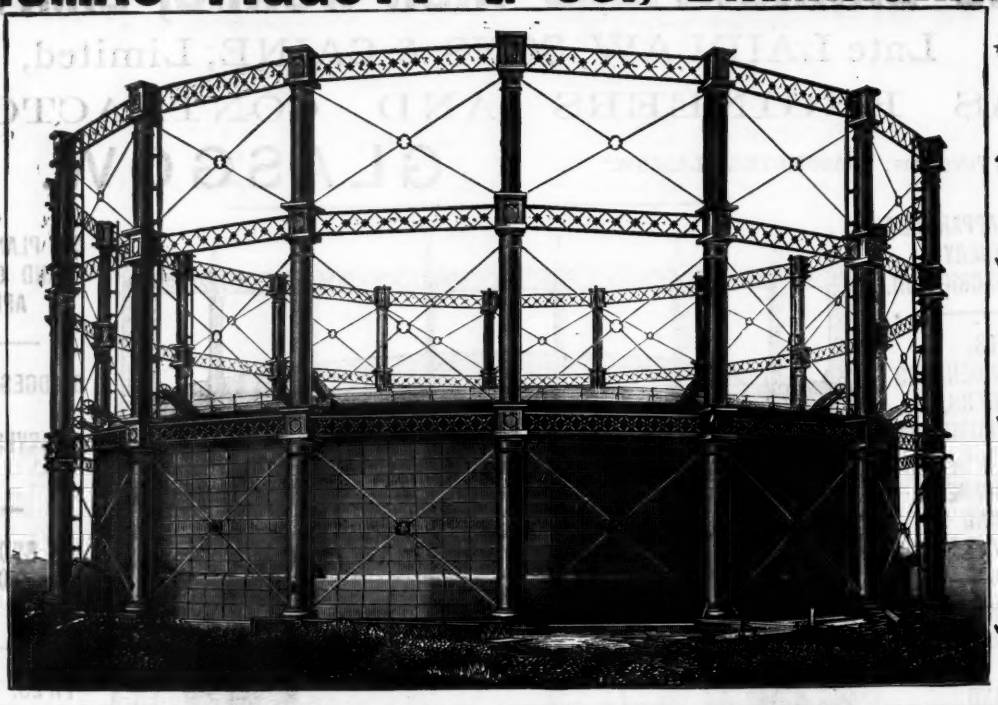

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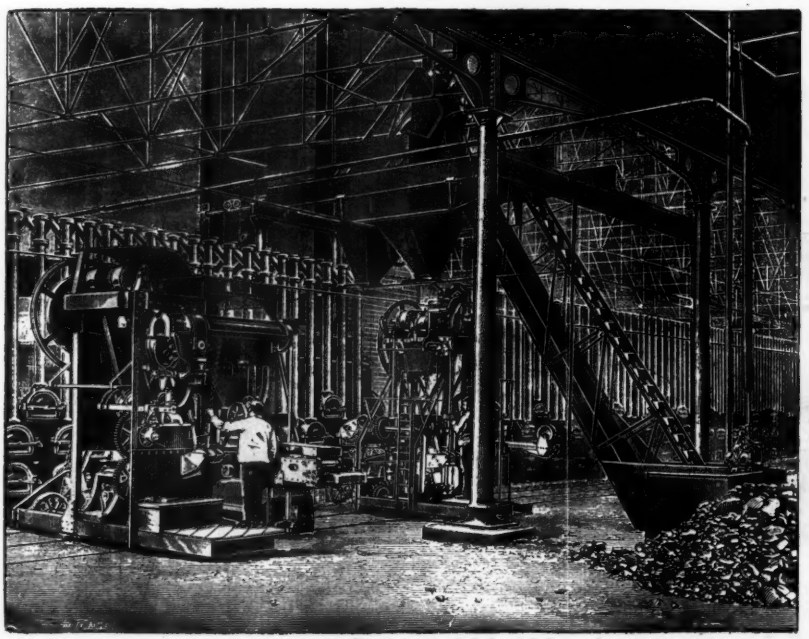
OVER **180** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.



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RETORT MOUTHPIECES

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RETORTS CAREFULLY PACKED FOR EXPORT.

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ESTABLISHED MORE THAN A QUARTER OF A CENTURY

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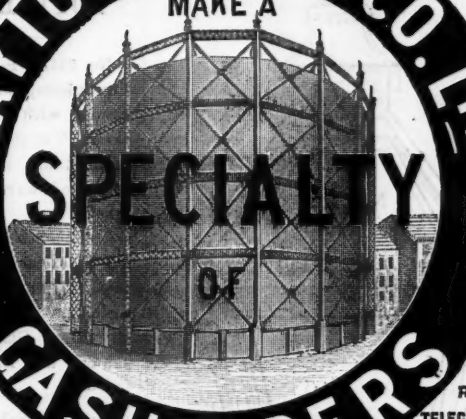

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Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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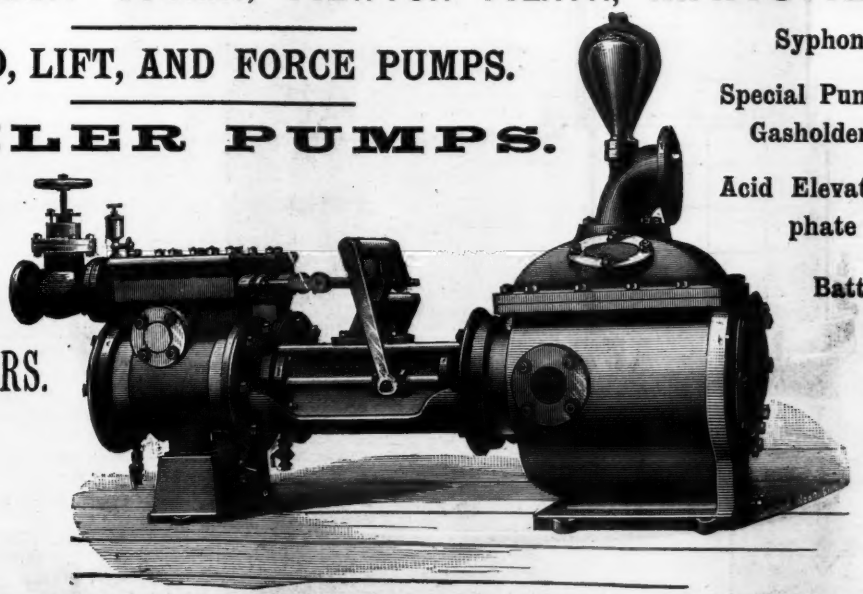
BOILER PUMPS.

PUMPS For SCRUBBERS.



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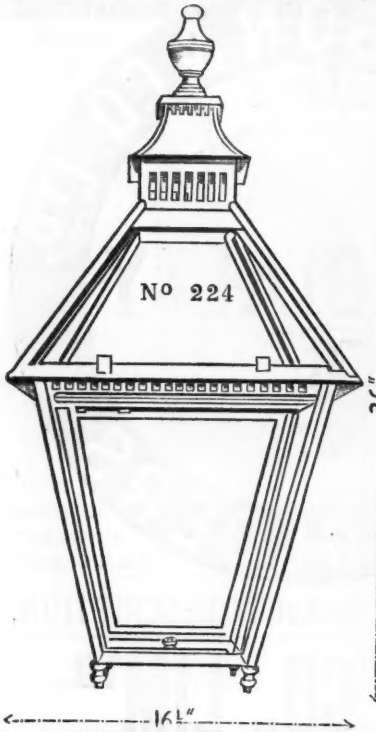

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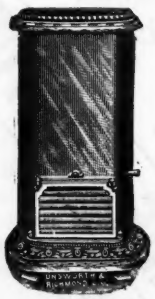
No. 224. **Puttyless Street Lamp,** all Copper Frame, **with Lighting Door.** The glass being fixed in our improved grooved bars, new squares can be inserted in much less time, and less wear and tear to the Lamp, than by the old method. Glazed all Clear Glass and painted any Approved Colour.	16½	15
	21/6	19/6
Extra Opal Top Squares, 2/3 per Lamp.		
Extra Pins and Nuts, 1/6.		
No. 225. **Ordinary Puttied Lamp,** as above	20/-	18/-



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Ready Oct. 20.

No. 550.

Made of Blue Coated Steel, with a surface equal to Plate Glass.

Requires no Black Varnish, and can easily be kept Clean with a Dry Duster.

SIZE: 30in. high, 18in. wide over all.

Price, 22s.

Suitable for Rooms 14ft. square.

No. 560.

This is a handsome Stove, with Bright Copper Reflector, and body of Bright Blue Coated Steel, fitted with Hot-Air Tubes, suitable for Entrance-Halls, or rooms up to about 18ft. square, and burns with a white flame.

SIZE: 21½in. wide x 16in. deep x 34in. high.

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Splendid Patterns of Square and Hexagonal Lamps in Stock. Write for Lists.

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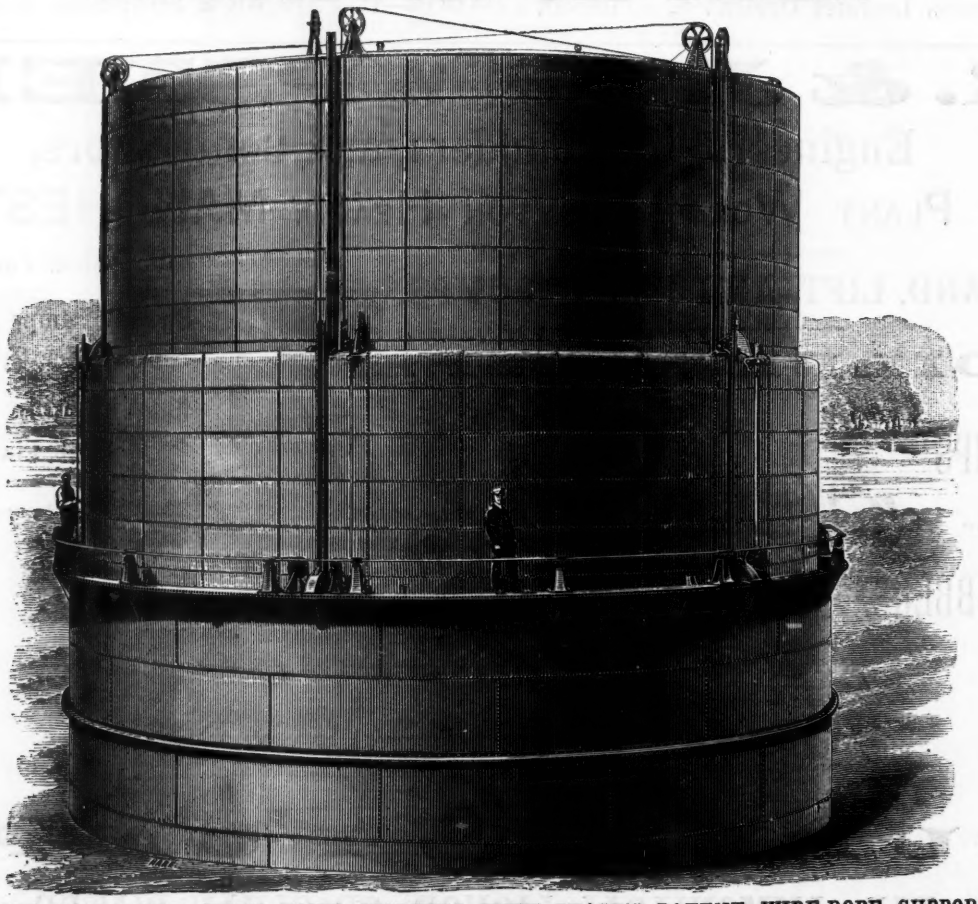

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(From Photograph.)

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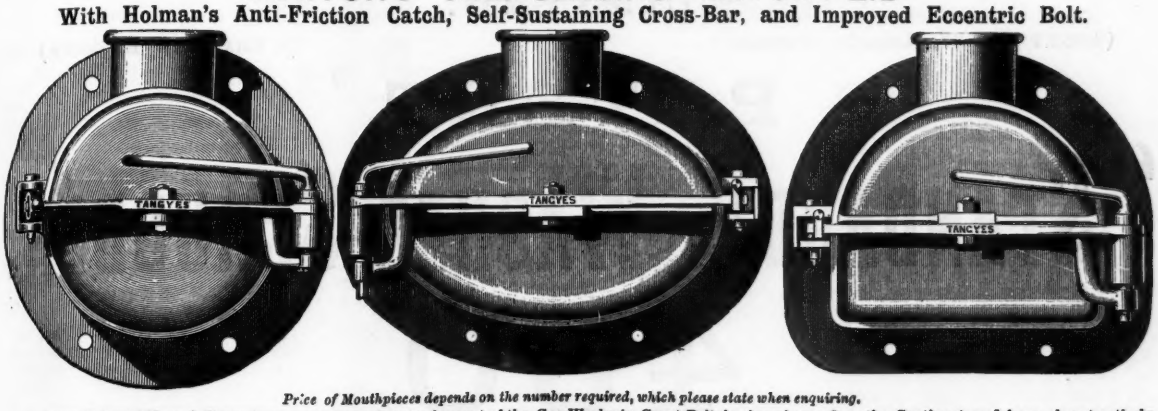
MORTON'S SELF-SEALING RETORT-LID

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



Price of Mouthpieces depends on the number required, which please state when enquiring.

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
3494	14 ins.	14 ins.	12½ ins.	£0 19 0
2982	15 ,,	15 ,,	14 ,,	1 0 0
3453	15 ,,	15 ,,	12⅛ ,,	1 0 0
3497	15 ,,	15 ,,	15 ,,	1 0 0
3630	16 ,,	16 ,,	10½ or 11⅜ ,,	1 1 0
4549	16 ,,	16 ,,	15⅛ ,,	1 1 0
6262	16 ,,	16 ,,	13¼ ,,	1 1 0
6396	16 ,,	16 ,,	15 ,,	1 1 0
7668	16 ,,	16 ,,	17⅞ ,,	1 1 0
10289	16 ,,	16 ,,	11 ,,	1 1 0
3356	17 ,,	17 ,,	15 ,,	1 3 0
7125	17 ,,	17 ,,	6 ,,	1 3 0
933	18 ,,	18 ,,	11⅜ ,,	1 5 0
4045	18 ,,	18 ,,	14 ,,	1 5 0
6397	18 ,,	18 ,,	15 ,,	1 5 0
8013	18 ,,	18 ,,	15 ,,	1 5 0

Taper Circular Mouthpieces with Circular Lids for Round Retorts.

	Front.	Back.			
13001	15 to 21 ins.		21 ins. diam.	13½ ins.	£1 0 0
13261	15 ,, 24 ,,		15 ,,	13½ ,,	1 0 0
12995	15 ,, 30 ,,		30 ,,	13 ,,	1 0 0
9562	18 ,, 21 ,,		21 ,,	12½ ,,	1 5 0
10425	18 ,, 21 ,,		21 ,,	4½ ,,	1 5 0
13418	18 ,, 22 ,,		22 ,,	12 ,,	1 5 0
13396	20 ,, 20⅝ ,,		20⅝ ,,	4 ,,	1 11 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 18 ins.	7 ins.	£0 19 0
14209	14 ,,	14 ,, 13 ,,	13½ ,,	0 19 0
14231	14 ,,	12⅝ ,, 12⅝ ,,	10 ,,	0 19 0
3468	15 ,,	15 ,, 13 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15 ,,	15½ ,, 13 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 13 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12⅝ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13⅝ ,,	12½ ,,	1 1 0
4434	16 ,,	17⅛ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	18½ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ or 19 ,,	1 1 0
8049A	16 ,,	18 ,, 15 ,,	17⅞ ,,	1 1 0
6137	16 ,,	20½ ,, 13½ ,,	13½ ,,	1 1 0
5018	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19⅝ ,, 13 ,,	14⅛ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15⅛ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7075	17 ,,	21 ,, 15 ,,	14⅛ ,,	1 3 0
13459	17 ,,	21½ ,, 13½ ,,	15 ,,	1 3 0
14284	18 ,,	18 ,, 13½ ,,	19 ,,	1 5 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18⅛ ,, 15 ,,	18 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	12⅝ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6475	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17½ ,,	1 5 0
13998	18 ,,	20 ,, 14 ,,	19½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	15½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19⅝ ,,	1 5 0
7356	18 ,,	20½ ,, 13½ ,,	18 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
13999	18 ,,	22 ,, 14 ,,	19½ ,,	1 5 0
7640	18 ,,	22 ,, 12½ ,,	18½ ,,	1 5 0
14250	19 ,,	19 ,, 14 ,,	19 ,,	1 8 6
14286	19 ,,	20 ,, 13½ ,,	20 ,,	1 8 6
7971A	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0
14285	20 ,,	21 ,, 13½ ,,	19 ,,	1 11 0

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	12⅝ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18½ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15⅝ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	13½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	13½ or 15 ,,	1 5 0
3554	18 ,,	21 ,, 15 ,,	14⅝ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048A	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
9800	18 × 14¾ ins.	18 × 14¾ ins.	15 ins.	£1 5 0
9205	20 ,, 13 ,,	24 ,, 14 ,,	10½ ,,	1 10 0
10000	20½ ,, 14½ ,,	20½ ,, 14½ ,,	16 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15¾ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	22½ ,, 13⅝ ,,	22½ ,, 13⅝ ,,	13⅝ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15½ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	16 ,,	1 18 0
13884	24 ,, 15 ,,	24 ,, 15 ,,	10 ,,	1 18 0

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Re.ort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
12292	15½ × 18 ins.	15½ × 18 ins.	12 ins.	£1 2 0
9967	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16⅝ ,, 13⅝ ,,	16⅝ ,, 18⅝ ,,	12½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
12980	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13⅝ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 13½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13½ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11098	18 ,, 14 ,,	18 ,, 14 ,,	12 ,,	1 6 0
9492	20 ,, 12 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15½ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13½ ,,	1 10 0
9909	20 ,, 13½ ,,	20 ,, 13½ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
14287	20½ ,, 14⅞ ,,	20½ ,, 4⅞ ,,	17 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
13992	21 ,, 16 ,,	21 ,, 16 ,,	17 ,,	1 11 0
8977	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 12 0
8976	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 12 0
10497	21½ ,, 13½ ,,	21 ,, 13½ ,,	18½ ,,	1 12 0
8037	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 12 0
9908	21½ ,, 13½ ,,	21½ ,, 13½ ,,	15 ,,	1 12 0
10404	21½ ,, 13½ ,,	22 ,, 14 ,,	18½ ,,	1 12 0
12410	21½ ,, 13½ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13½ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 12½ ,,	22½ ,, 12½ ,,	18½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	15½ ,,	1 13 0
13807	24 ,, 15½ ,,	24 ,, 15½ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	12½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	13½ ,,	1 15 0
12944B	23 ,, 16 ,,	23 ,, 16 ,,	16 ,,	1 15 0
14037	22 ,, 16 ,,	2 ,, 16 ,,	16 ,,	1 15 0
14119	22 ,, 16 ,,	22 ,, 16 ,,	18 ,,	1 15 0

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.

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Size.	Depth, Back to Front.	Height, including Unions.	Width, including Unions.
Lights.	Inches.	Inches.	Inches.
2	7¼	13¾	10
3	8⅝	15	11¼
5	9½	16¾	13
10	10¾	19	15
20	13¼	24½	18½
30	16⅛	27½	21¼
50	20¼	33¼	26
60	21	33½	27
80	24¼	40½	31
100	25½	42¼	33¼
150	27¾	50¾	42
200	30	56¾	42¾
250	34¼	58	46¼
300	38¼	63¼	49¼
400	41¾	72¼	56¼
500	46	74	57½

150 Lights and upwards.

Measuring Capacity.

Size.	Bore of Inlet and Outlet.	Per Revolution.	Per Hour.
Lights.	Inches.	Cub. Ft.	Cub. Ft.
2	½	0·083	12
3	⅝	0·125	18
5	¾	0·160	30
10	1	0·3	60
20	1¼	0·5	120
30	1⅜	0·830	180
50	1½	1·428	300
60	1¾	1·6	360
80	2	2·5	480
100	2	2·857	600
150	3	5·0	900
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300	4	8·3	1800
400	5	12·0	2400
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9th—Will last much longer than Wet Meters.
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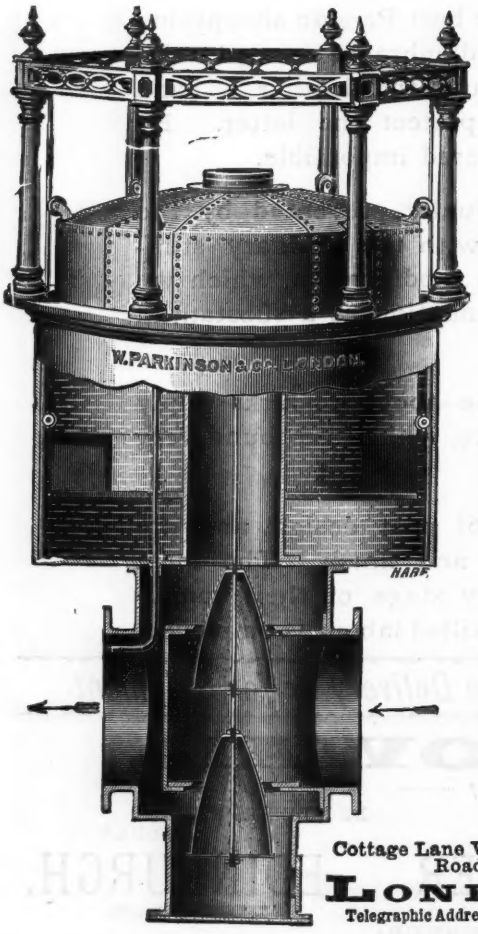

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 20, 1891.

The Standard of Light and Stamped Photometers.

THE question of the standard of light appears to be in a condition distinctly unfavourable to a speedy or a satisfactory solution. As will be seen in another column, the Sanitary and General Purposes Committee of the London County Council have reported to the Council that the whole matter has come to a deadlock as between themselves and the Board of Trade. The Council have decided to introduce a Bill into Parliament next session for altering the standard of light; but it is one thing to abolish an admittedly defective standard, and quite another to find a perfect one to put in its place. The Board of Trade have intimated their desire to appoint a Committee to consider this aspect of the question; but a difficulty has arisen with regard to the expenses of such a Committee. The Board of Trade declare that they have no funds available for such a purpose, and ask the Council to bear the cost. The Council reply that they are in the same position; whereupon the Board rejoin that, as no funds seem to be forthcoming for the purpose from any quarter, the proposed inquiry cannot be held. The Council express their regret at this "impotent conclusion" of an important negotiation, and also confess to entertaining some fear lest their own parliamentary project for the disestablishment of the standard candle may be prejudicially affected by the absence of an authoritative suggestion in regard to the candle's successor. It appears to us that neither the Board of Trade nor the County Council occupies a strictly logical position in respect to this matter. On the one hand, it is not a very rational or dignified proceeding on the part of the Board to proffer action for which they are not prepared to take the entire responsibility, pecuniary and otherwise. Besides, it may be asked, how was it that the Department appointed and paid for a Technical Committee something like ten years ago, if they can only do one half of the same administrative duty now? Where did the funds come from then, and why is not the same source available again? On the other side, it seems a left-handed way of going to work for the County Council to try and abolish a standard, without providing trustworthy evidence of the existence of something better to put in its place. They do not presume to tell the Board of Trade that the idea of a Technical Commission to investigate and report upon the subject for the guidance of Parliament is unnecessary, inasmuch as they are fully prepared with all requisite evidence on this head. Indeed, the Council admit the desirability of such an inquiry, and tremble for their Bill in default of the support which a strong Technical Committee could lend it; yet they will neither pay for such a Committee if appointed by the Board of Trade, nor appoint and pay for one of their own. It is perfectly reasonable to assert that the question of ascertaining what is the best standard of light is one of Imperial importance; but the admission sounds strangely from a body who are at the same time preparing to do away with the only standard recognized by the law. Surely, any substitute for the candle which the London County Council would be justified in imposing upon London ought to be good enough for the entire kingdom; but if there is no authoritative declaration as to what should be the legalized standard of light for the whole country, how can there be anything good enough for London? Unless this point is cleared up, we fear that the contemplated parliamentary action of the Council in this matter will only eventuate in another *fiasco* not creditable to the business capacity of this ambitious body.

While mentioning the subject of the legal standard of light, we may refer to the progress that is being made by the Standards Department in stamping Evans and Letheby photometers for statutory Gas Companies, in pursuance of the notification issued by the Department in July last. We are informed that Evans photometers have been stamped for the Brentford and Godalming Companies; and that several Letheby photometers have also been approved. The first Gas Company in this country to have a photometer stamped by the Standards Department was the North Bierley Company; but the business is now waxing very brisk, and consequently some inconvenience may be experienced by reason of the delays inevitable in connection with work of this kind. The Standards Department does not possess the attribute of unlimited powers of expansion; and therefore apparatus submitted for examination and stamping must wait its turn. Meanwhile, it is very doubtful if the validity of any test made with an unstamped instrument could be maintained in a Court of Law. There is no exception to the range of the powers of the Standards Department; and all Gas Companies working under the Gas-Works Clauses Act must consequently conform to the new requirement. If this is the correct interpretation of the law, and all the tests now made with unstamped photometers by the Metropolitan Gas Examiners are *ultra vires*, it is strange that the Referees keep so quiet about it.

The Progress of the Danish Gas Company.

DIFFICULTIES, said a wise man once, are opportunities; and the saying comes forcibly into one's remembrance when glancing over the report which Mr. F. D. Marshall, the Chief Engineer of the Danish Gas Company, has

just presented to his Directors. This interesting statement will be found in another column. It is a report not only upon the last year's working of the undertaking, but also upon the general progress of the concern since it has been under Mr. Marshall's supervision. It has been very uphill work to make the stolid Danes take to gas as freely as this report proves that they are now doing; and in any part of the world such growth of a gas undertaking as the Danish Company's accounts display would be phenomenal. When it is remembered, however, that Mr. Marshall's works do not serve new and rapidly-growing communities like the manufacturing cities of England and North America, but supply the most steady-going of towns in that old district of Northern Europe which was Old England long before the name was given to this island, the success of the Company appears truly wonderful. The output of gas consumed for lighting has increased, under the skilful manipulation of Mr. Marshall and his colleague Mr. Cridland (who were, of course, thoroughly well supported by the Board), by 105 per cent. in ten years. The quantity of gas used for cooking has during the same time augmented by 318 per cent.; and the consumption for motive power has increased by 540 per cent.—as remarkable a record as ever came under our notice. We believe, moreover, that in Denmark the Gas Companies have been compelled to rely absolutely upon themselves for everything. In no way whatever have they been aided, as is the case in England, by enterprising gas apparatus manufacturers, gas-fitters, and ironmongers. Interest in gas-stoves, &c., has therefore been of necessity created by those who had the sole motive of selling gas; and it would be a curious question whether this circumstance has not been, on the whole, rather favourable to the issue than otherwise. It must not be overlooked, either, that the system employed by Mr. Marshall in his efforts to popularize gas consumption is essentially one of differential charges. Yet it appears that in this case, as in others to which reference might be made, difference has led in the end to uniformity. Ten years ago the average prices of gas sold by the Danish Company were 7s. per 1000 cubic feet for lighting, and 5s. per 1000 feet for cooking purposes; whereas at the present time the price averages 3s. 6d., and the differential rates are nowhere so marked as they were in 1881. It is interesting also to notice what Mr. Marshall has to say about the efficiency of the best gas-burners in restoring to gas the economical advantage which cheap petroleum had wrested from it. Altogether, the report is very noteworthy as an example of the vitality that is inherent in gas undertakings when managed in a really enlightened commercial spirit. The Danish Company have their own troubles and drawbacks, of course, like all other trading concerns; but there is evidently a broadly practical spirit in the management, that makes the business of gas supply in this particular instance a very "live" one indeed.

The Census of American Gas Undertakings.

When, a short time since, we drew attention to the extreme development of the "circular of inquiry" nuisance in the shape of the question-paper issued to managers of United States gas-works by the authority of the Census Officer of the Union, we had no idea that this inquisitorial document would provoke the patient American citizens to whom it had been addressed to one of their rare outbursts against the bungling of their astonishing Government. Yet so it is; and recent mails have brought to us abundant evidence that in this instance what we called the great American national amusement of census-taking has been rather overdone. The appointment of the Superintendent of Census was, of course, a purely political move; and when the officer who obtained the post was told that he might spend eight millions of dollars upon the job, he fully realized the extent of his opportunities. Faithful supporters of the party in office were nominated all over the country to the pleasing duty of helping to spend the dollars; and by the ingenious way in which they spun out their lists of questions, it soon appeared that these industrious gentlemen did not mean to stop their inquiries while a cent remained to further the "important" work. There is always a risk, however, that the best of jokes may be carried too far; and this is what Mr. Census Superintendent Porter and his satellites have done, in the estimation of their victims. The Gas Companies have protested in strong terms against the infliction with which they have been visited in the name of the Census; but this is not all. It is loudly asserted that the elaboration of the plan of the Census is only surpassed by the carelessness, and even obliquity of vision, with which it has been carried out; so that the Census is really worse than useless as a record of the actual condition of the arts and occupations of the people of the United States. To crown the whole, the Superintendent has spent all his funds; and the complete Census returns will probably never see the light after all, unless a large additional appropriation is made by the Treasury for the purpose. Truly, it was well known that government by the New Democracy of the Free West was not economical; but it appears to be growing less efficient every year.

Lamp Accidents.

People in England do not blow out their gas, which appears to be a common trick in some parts of the globe; but they do blow out petroleum-oil lamps, to say nothing of upsetting, breaking, and otherwise "monkeying"—to use an expressive term—with these dangerous appliances. The past fortnight has been marked with several horrible "accidents" due to petroleum lamps; and it is not to be wondered at, therefore, that the newspapers have had a spasm of alarm in contemplating the terrible ease and suddenness with which a disaster may happen in connection with mineral-oil lighting. One of our contemporaries calls somewhat hysterically upon Government to "do something" to check the mischief that happens every year through cheap oil and cheap lamps. Another echoes the cry of alarm; and so quite a little fit of excitement is worked up over the subject, until the next "incident" happens to head off public attention into another channel. It is always the same story over and over again. The "many-headed mob" no longer cries its passions of an hour in the streets, but fills its newspapers, instead, with the notions that occur to it from time to time. Why does not Government do this, that, or the other thing, the desirability of which in all probability never occurred to the newspaper writer who advocates it until the moment when he was called upon to "make copy" out of some peculiarly horrible catastrophe, like that at Liverpool, reported in last week's Journal? It is this flighty, haphazard way of treating grave social questions which so often inspires specialists with a disgust of newspapers. Why, in this very matter of the supervision of the construction of petroleum lamps, a Government Department has been working for years, with the co-operation of the best lamp makers, to protect lamp users from consequences which a harsh observer would describe as generally brought about solely by their own recklessness and folly; and what assistance have the newspapers rendered to the cause? Have they lent the publicity of their columns to the authoritative cautions that have been given with regard to the selection and use of lamps? Nothing of the kind. If the most valuable matter of this sort—information upon the right use of which the lives of many hundreds of families might depend—came to the hand of the average newspaper editor simultaneously with some nauseous Divorce Court report, and he had not space for both, is there any doubt as to which class of matter he would sacrifice? And then, when three or four people are burnt to death through a lamp accident, the newspaper editor wonders, through half a column, why Government has not "done something" to inspire caution in the handling of lamps! It is not only the poor and ignorant, moreover, who are exposed to the danger of lamp accidents, as the case of the late Lord Romilly shows. The fact of the matter is that the portable petroleum lamp is always potentially dangerous. Nobody who uses such a means of lighting can be so assured that nothing will happen to his lamps, as a consumer of gas is with regard to his burners. What special danger there may be in gas applies to it only when the light is not in use. With petroleum lamps, on the other hand, danger exists at all times and in all circumstances, and especially when it might be least expected—that is to say, when the lamp is being extinguished. At the same time, as we have no desire to cry "Wolf" without excuse, we freely admit that, by the exercise of reasonable prudence, lamp users may escape the worst evils that threaten their order. So long as human nature remains what it is, however, and while there exists the man who will seek for an escape of gas by means of a naked light, there must continue to be

lamp "accidents" of a more or less preventible kind, alongside of the others which are inherent in the method of lighting, and which no exercise of human foresight could avail to prevent.

"Looking into Things."

READING the other day an interesting paper presented to the American Society of Civil Engineers by Dr. Charles E. Emery, we noticed with considerable amusement a statement by the author referring to a cause for the tribulations that attended the early days of a certain supply Company of New York. The concern in question was of the same general order which includes gas and water and electric light companies; that is to say, it required a mutually reliant organization, and could only do its internal and external work efficiently when its composition was that of a microcosm, with every individual member contributing in his degree to the harmonious working of the whole. To the supreme control of this New York undertaking came a gentleman described as "a most charming person socially "and intellectually;" but who was also an unusually bright specimen of the variety of man known in American parlance as the "hustler." He believed, we are told, in "looking "after things;" and Dr. Emery describes, not without some humour, how this principle worked in the case in point. No amount of persuasion or argument could impress this energetic gentleman with a sense of the necessity of organizing and building up all great enterprises by the aid of well-informed, skilful, and reliable employes of all grades, who might be trusted to do good work even when out of sight, and could be left without harassment to do their part. "On the contrary, every one, from the labourers up, "was urged to hasten his own work, and called upon, around "the street corners, at the office, or at the hotel, to report "progress, and report the shortcomings of others." While money could be had for the asking, big offices were taken "to give the Company business standing;" while the works were pushed on by the aid of borrowed funds. By-and-bye, when times grew hard, there would be a sudden order to reduce all wages 10 per cent., and to put 50 per cent. more sand with the cement. Then the Management complained of the Engineer, and went about asking advice of anybody and everybody as to what ought to be done to meet difficulties which mainly arose through incapacity at head-quarters. Is the picture unfamiliar to our readers? Unfortunately, it is to be feared that the "hustling" style of administration is not unknown even in connection with the statutory Gas Companies of the United Kingdom. In Dr. Emery's cited example, affairs arrived at the climax just in time to save the undertaking. Good men were put in immediate control of the secretarial and engineering departments; and these gentlemen were driven to the length of impeaching the General Management. The declaration was made "that the President of "the Company must alone be held responsible for his acts;" the result of which was that the presidency soon afterwards fell into other hands, and the period of worry, espionage, and disorganization was succeeded by an age of quiet but earnest work, eventuating in technical efficiency and commercial success.

The Changes in the Staff of The Gaslight and Coke Company.—We have received a communication to the effect that the paragraph under the above title which appeared in the last issue of the JOURNAL is not literally accurate with reference to Mr. Trewby's position in the new arrangement. We are now informed that, by the terms of the minute regulating the matter, he is to act as Consulting Engineer to the Company, and his title is "Consulting and Constructing Engineer."

The Assistant Engineership of the Huddersfield Gas-Works.—Mr. W. Ralph Herring, who has for nearly eight years filled the position of Draughtsman and Assistant at the Hastings Gas-Works, has been appointed (subject to the approval of the Council) Assistant Engineer and Manager, under Mr. J. Burgess, Assoc. M. Inst. C. E., of the Huddersfield Corporation Gas-Works. There were upwards of 90 applicants for the appointment, in response to the advertisement which appeared in our columns a few weeks ago.

The Self-Purification of Rivers.—At the Annual Congress of German Naturalists and Medical Men, just held at Halle, an interesting paper was read in the Hygienic Section, by Professor Von Pettenkofer, on the self-purification of rivers. He considers that the great quantity of low vegetable organisms in water plays an important part in the purifying process. The vegetable growth in river-beds should, according to him, be protected; and refuse water from mills, chemical works, &c., which is destructive to vegetable growth, should not be allowed to flow unpurified into rivers.

WATER AND SANITARY AFFAIRS.

A LONG debate at the County Council has terminated in the adoption of all the recommendations given in the report of the Special Committee on Water Supply. Mr. Beachcroft could muster no more than 17 votes in favour of his amendments, in opposition to 68 that went against him. Perhaps even this minority, amounting to 20 per cent. of the total votes, may be considered a little remarkable, as existing in a body constituted like the County Council. But what we have to deal with now is the decision of the majority, distinctly opposing the recommendation of the Select Committee of last session, that if constituted the Water Authority for the Metropolis, the Council should be required to purchase the undertakings of the eight Water Companies, "by agreement, or, failing "agreement, by arbitration, within a fixed period." The Council, by one of its resolutions, declares that "before "any terms of purchase can be considered," the liabilities to capital expenditure for new or supplementary sources of supply in the immediate future should be authoritatively ascertained. That is to say, an inquiry is to come first—having reference to "future wants;" the obvious intention being to depreciate as much as possible the existing undertakings by the threat of a new supply. The Council has practically decided, as suggested in the report of its Special Water Committee, that "compulsory purchase" shall not be "a condition "of further progress." But the Council need not "progress" at all in this matter, unless it likes. If the conditions are unacceptable, the Council may let the whole water question slide. The Select Committee were prepared for such a contingency; and they have provided for it. They recommended that, in the event of the undertakings of the Companies not being acquired by purchase, there should be a parliamentary inquiry (before which the interests of the whole of the consumers within the area of the present Metropolitan Water Supply should be represented) into the statutory powers and obligations of the Water Companies, and the control which is now exercised over them by public departments and the Metropolitan and other authorities. This recommendation is followed by the remark that it might probably be found advantageous to make the obligations of the Companies, and the control to which they are subject, "more complete." It is left quite optional with the County Council whether or not that body shall seek to become "the responsible Water Authority for London." The report of the Select Committee leaves the way clearly open for the continued existence of the Water Companies, subject to some fresh conditions, if the question of purchase cannot be settled. This consideration covers not only the possibility of some failure on the part of the County Council, but also the absence of any "single public representative Water Authority." The County Council, therefore, in quarrelling with the report of the Select Committee, is ousting itself from the position which the Committee assigned to it. If "unable "to accept the condition" on which it is to act, the Council is quite at liberty to abstain from action.

The County Council being thus at issue with the recommendations of Sir Matthew Ridley's Committee, must needs seek some way of setting itself right with Parliament. In fact, it must induce the House of Commons, by some direct or indirect means, to throw over the leading recommendations of the Select Committee. So we find Mr. Dickinson saying, in the course of last week's debate, that the recommendations of the Special Water Committee had been brought forward in order to get the view of the Council upon broad questions of principle, "to lay before the Committee of the House of Commons "at some future period." According to a remark which fell from the lips of Mr. Rose-Innes at Rickmansworth the other day, it appears that the Corporation are going to bring the question of the Metropolitan Water Supply before Parliament in the coming session. This may open the way for the appearance of the County Council, if no other mode presents itself. But if a Select Committee is to undo in 1892 what was done by its predecessor in 1891, Parliament may be supposed not to know its own mind on the subject. Doubtless much remains to be said on the question of price. This has been left by the Select Committee to be settled by agreement or by arbitration, if it has to be settled at

all. The County Council, while disavowing spoliation, or anything of a confiscatory character, is seeking to lay down what is called "the basis" upon which the purchase of the undertakings is to be settled. Any basis but the Stock Exchange value is to be chosen. The "true value of the "undertakings" is to be determined by a complicated—we might almost say by a tricky—method, designed beforehand to work out a result as unfavourable as possible to the Water Companies. Sir Thomas Farrer cries "Heaven help us!" if the water undertakings of the Metropolis are to be bought up on the same terms as were observed in the Stockton and Middlesbrough case. Perhaps something less would satisfy the London Water Companies. But the County Council would like to give very much less, and would treat the London Companies after a fashion in which no Water Company was ever yet treated in this country. The ideas which actuate the Vice-Chairman on this subject are well illustrated by a letter which he has recently addressed to *The Times*. In the County Council, Sir T. Farrer objects to give the Water Companies the Stock Exchange value of their shares; but in this letter he argues that Metropolitan Stock should be accepted by the Companies according to its market value. At every turn the Companies are to be hit. If they amalgamate, the most extraordinary terms are to be forced upon them, as specified by Sir T. Farrer in his speech last Tuesday. Happily, the County Council is not the House of Commons, and its resolutions have not the authority of an Act of Parliament, although some of the speakers in the recent debate seemed to think that the destinies of the Water Companies were to be settled by a vote at Spring Gardens. Progress has not yet reached that point. In the meantime, thanks are due to Mr. Boulnois for the courage and ability with which he defended the rightful interests of the Companies, and to Mr. Beachcroft for his efforts to infuse some element of reason and justice into the propositions of Sir T. Farrer's Committee. As for the state in which the matter now rests, *The Times* declares that everything relative to the water question "is in a welter of confusion." Sir T. Farrer follows this up by a letter which appeared yesterday, in which he tries to show that the County Council and *The Times* are in perfect agreement.

The financial part of the Birmingham Water Scheme possesses interest for the inhabitants of the Metropolis for two reasons—first, as disproving the idea that the capital account of the London Water Companies is unduly swollen; and, secondly, as showing what may be expected if the London County Council should ever obtain power to take a supply from Mid-Wales, or from any equally remote spot. The Birmingham estimate for works sufficient to deliver 26 million gallons daily from the Welsh watershed is £3,340,000. This is at the rate of £128,488 of capital per million gallons daily. The capital of the London Water Companies at the close of 1889 was considerably under £15,000,000, or at the rate of £88,558 per million gallons of the average daily supply for the year. The Birmingham cost therefore appears, in regard to its ratio, as 45 per cent. higher than that of London; and it corresponds to a capital exceeding £21,500,000 for the present supply to the Metropolis. Granting that a six or seven fold supply does not actually involve a proportionate increase in the capital employed, it certainly means a very large addition to the outlay, approximating to such a result. The population now receiving a supply of water from the Birmingham works appears to be about 700,000. This is something like one-eighth of the population served by the London Companies. If we multiply the Birmingham estimate by eight, we get a corresponding capital of £26,725,000. Or if we allow that 26 million gallons per day will provide for a population of nearly 900,000, we may multiply by six, and show that the London Companies are still a long way within the mark. Proceeding in the next place to consider what the London County Council may seek to undertake, the question naturally presents itself: If it costs Birmingham so much to get a supply of 26 million gallons per day from a distance of eighty miles, what will it cost London to get a supply of 168 million gallons (last year's daily average) from a distance twice as great? In Mr. A. R. Binnie's report to the London County Council, Mr. Fulton's estimate is quoted as amounting to a total of £9,000,000 for a supply to London of 230 million gallons daily from Mid-Wales. This is nearly nine times the supply proposed for Birmingham; and yet Mr. Fulton's estimate is less than three times the amount contemplated by the authorities of the Midland city. Moreover, we are speaking of Birmingham's initial outlay. The total by-and-bye will not be far short of £6,000,000, though, of course, the supply will be enlarged so as to meet the wants of an increased population. But does anyone suppose that if Birmingham is to spend £6,000,000 on its water supply in the course of a few years, an outlay of £9,000,000, or anything like it, will suffice for London, especially when the water has to be brought double the distance? In the comparisons we have made, we do not pretend that the results are to be absolutely accepted. But the figures mean something; and they serve to throw grave doubt on the accuracy of Mr. Fulton's estimate, as applied to present circumstances. That estimate is now nearly a quarter of a century old, and the times have altered since it first appeared. Seeing how Birmingham is likely to be burdened by this Welsh project, London has further reason to consider whether any such scheme is either needful or desirable for the Metropolis.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 725.)

THE Stock Markets opened rather dull last week, and remained for some time quiet and heavy. The absence of the Hebrew contingent on Monday, and interruption caused by the gale of the next two days, kept things down. An improvement set in afterwards, especially when it was found that the Bank rate would stand unchanged; and the better feeling lasted till the close. Gas has had a big fall, owing to one of those electric scares which operators know so well how to work. However, we have had them before, and have recovered from them, as we shall recover from this; and then comes the day of remorse for the week-kneed and timorous who have jettisoned their holding. Some nonsense has been talked about the fall in prices being caused by the speech of the Chairman of the Commercial Gas Company. A very few moments' reflection will suffice to dissipate this error. The fall in Gas stocks had not only been greatly foreseen and expected for some considerable time, but had actually begun before the date of the Commercial Company's meeting. Beyond this, what the Chairman said—or the pith of it—was already before the public in the shape of the printed report and accounts; so that his speech contained no revelation. And if that is not enough, the fall is general and widespread—embracing the chief Continental undertakings. In the result, the fall has been sharp and heavy; and signs are not wanting of a tendency to buy back already. The record of Gaslight "A" is almost phenomenal. It was done at 228 on Monday and 206 on Saturday. The shrinkage in value of 22 in the £100 stock, calculated upon an issue of five-and-a-half millions, will work out a large figure. The "H" has dropped 4; and the "K," 4½. Not much was done in South Metropolitans; but the quotations of all the issues have been lowered more or less. In Commercials, the old stock was knocked down 8; but the new stood firm. The Suburban and Provincial Companies have not been much affected by the fall, except Crystal Palace; and business in them was very restricted. The Continental undertakings were flat, and lost ground to the extent marked on the price list. The rest of the foreigners were without feature, except San Paulo, which rose ½. The Water Companies were moderately dealt in. But the tendency was rather flat; and two or three issues receded.

The daily operations were: Gas was very quiet on Monday, and the prices of what few stocks were dealt in were fair. Even less business was done on Tuesday; and prices were not supported—Gaslight "A" falling 1; and ditto "K," 2. Transactions on Wednesday were more numerous; and prices generally were little affected, though there was a drop of 1 in Gaslight "A" and Imperial Continental. The weakness was more pronounced on Thursday; all the chief issues receding. Gaslight "A" fell 4; ditto "H," 1½; South Metropolitan "A," 5; Commercial old, 3; and Imperial Continental, 2. On Friday, quotations were knocked about anyhow. Gaslight "A" fell 10½; ditto "C," "D," and "E," 2; ditto "H" and "K," 2½ each; South Metropolitan "A" and "C," Commercial old, and Continental Union, 5 each; South Metropolitan "B," 2½; and Imperial Continental, 3. On Saturday there was extensive dealing in Gaslight "A" at very wide prices, ranging from 206 to 214; and Imperial Continental also was similarly affected, but in a lesser degree. Quotations remain unchanged, except for a fall of 4½ in Crystal Palace.

Railway Carriage Lighting by Pintsch Gas.—A Pintsch gas plant has recently been completed at Omaha (U.S.A.), to supply the gas to the trains running between Minneapolis and Duluth, Kansas City, Sioux City, and Omaha.

ELECTRIC LIGHTING MEMORANDA.

The City of London Electric Lighting Company—Sir David Salomons on the Cost of Electric Lighting—The Valuation of Arc Lamps.—An "Amende" to a Contemporary.

THE City of London Electric Lighting Company held their first ordinary general meeting last Thursday, when the Chairman (Sir David Salomons) went a little into the position and prospects of the undertaking. This is the concern that paid £40,000 to the City of London Pioneer Company for promotion and various expensive privileges, including the patronage of a Lord Mayor. Judging from what was said at the meeting, the shareholders seem well satisfied with their bargain; but it is as yet early days with the Company, and the youth of most electric lighting ventures has been full of a promise that is not invariably fulfilled in after years. The Chairman stated that the Company have already 26 lamps alight in Queen Victoria Street, and they are only waiting for the formal approval of the lamp-posts by the City Engineer to extend the light to the other scheduled districts—part of which will be supplied with Brush and the remainder with Thomson-Houston lamps. The plant to be laid down is to be sufficient for the supply of 400,000 eight-candle incandescent lamps for private lighting, besides the arc lamps in the streets. This is rather a large order; and we doubt whether the whole of this business will be forthcoming for a long time yet. It is stated that the Company have already received 200 applications for light, which the Chairman liberally averages at 200 candles apiece all round, and thus arrives at a present demand for 40,000 lights. How the managers of the other London electric lighting companies, who have had a year or two's experience of the meaning of such promises of support as these, must smile in their sleeves over the exuberant hopes of every fresh adventurer into this particular field! We make bold to prophesy one thing about this Company—that the eight-candle lamps which are supposed to constitute the staple of their service for private lighting, will not be good enough for City use. It is almost a "fad" of General Webber, the Company's Chief Engineer, who draws his experience from Chelsea, that eight-candle lamps are as good as sixteen-candle lamps, provided that consumers are not allowed an opportunity for making the comparison. But shopkeepers and men of business generally are not likely to be put off with any such pretence. When a tradesman elects to pay an increased price for electric lighting, he does not wish his shop to look darker than that of his neighbour who continues to burn gas. The public do not care a straw how a shop is lit; but they are attracted, like moths, to the brightest. As a matter of fact, shopkeepers in the City of London who make their own electric lighting find 64-candle lamps none too brilliant; but when it comes to renting such lamps of a public supply company, the most enterprising shopkeeper looks at the expense, and refrains.

Speaking of the cost of electric lighting at the City of London Company's meeting, Sir David Salomons said that he had been often asked the question; and he put it that, with electricity at 8d. per unit (which he remarked would be about the price in the City) an eight-candle lamp will cost as nearly as possible ¼d. per hour. This is quite correct, taking the duty of the lamp at 4 watts per candle. But seeing that Sir D. Salomons is so well disposed to speak truth in matters of this kind, is it too much to hope that he will discountenance the rating of the Company's Brush arc lamps by "French measurement"? Perhaps it was, however, that the Chairman had already suffered contamination by his dealings with the Brush system; but he did not adhere to the truth quite so rigidly when he went on to state the equivalent cost of gas lighting. He made his farthing lamps balance gas at 4s. 6d. or 5s. per 1000 cubic feet. Now, many electricians have adopted the rule that the price of electricity in pence per unit can be translated into shillings per 1000 cubic feet for the equivalent light in gas. This is a tolerably fair approximation, and has the advantage of being easy to remember. It is slightly too favourable to the electricity, having regard to the cost of renewals of lamps. But we are not disposed to insist over-much upon this point. The effect of the rule is good enough for us in a general way. In the case in point, it would make electric lighting in the City of London as dear as gas at 8s. per 1000 cubic feet, which is a very different thing from Sir D. Salomons's estimate. There is nothing gained by misstatements of this kind. The consumer finds them out with his first lighting bill; and he is apt to be wroth, with the resentment of a man who feels that he has been "done." No resentment is so lasting and bitter as this, in the estimation of a man of business; and it is little short of marvellous that electricians lay themselves so open to it by absurdly understating the real extent of their charges.

The scandal of the deliberate misstatement of the illuminating power of arc lamps, originally due to the Brush Company, has aroused the *Electrical World* to protest against the continuance of the practice. It is admitted that the terms 1200 and 2000 candle power as applied to arc lamps are merely trade names; the former being applied to a six or seven ampère high-tension lamp, the latter to a nine or ten ampère lamp. The proposal is once more made to classify the lamps by watts; the so-called 1200-candle lamp would then rank as a 300-watt lamp, and the 2000-candle lamp as a 450-watt lamp. This would be a simple and intelligible system; and under it electric lighting contractors would be able to satisfy their customers that they are actually supplying the power required. We should welcome the change, but have little expectation of seeing it brought about until local authorities pay for their arc lighting by actual measurement of the energy employed. Until then the impudent rating of electric lamps at four times their average illuminating value will be persisted in, because it furnishes such startling data respecting the comparative performance of electricity and gas in street lighting. That it is always exposed sooner or later, is beside the question; for before the light is shown, the contract is secured, and that is the main object of the misrepresentation. Electricians are all honourable men, of course; but one could wish they were a little more scrupulous as to the means whereby they obtain their contracts. It is possible to believe, moreover, that by this scrupulousness in avoiding anything like a false pretence, they would avoid many disputes and much recrimination.

We have to make the *amende honorable* to our financial contemporary *Money*. Recently, in animadverting upon the plague of venal financial journalism with which this age is cursed, we roundly declared that the financial organs which profess to guide the investor, while they can all heap contumely now upon the tricks of the electric promoters of light of nine years ago, never said a word against these scandalous practices at the time. We should have specially excepted *Money*, which, as we are ready to concede, was alone with us in testifying to the hollowness of the schemes in question, whereby, with the shameful connivance of the Press in general, the British public was practically robbed of millions of money. In making this acknowledgment of the honourable part played by this our contemporary, we do but accentuate the disgraceful conduct of the rest, which, if they were not actually bought over to the cause of the spoilers, had neither perception enough to see that a huge swindle was being perpetrated under their editorial noses, nor strength enough to stem the mad rush along the road to ruin upon which they are now ready enough to moralize.

Mr. J. Chamberlain, M. Inst. M. E., formerly of Beckton, who left England a few years ago to take an appointment in Melbourne, recently completed an engagement with the Charters Towers (Queensland) Gas Company to superintend the carrying out of extensions and improvements at their works, and started on a tour of the colony. We learn that, in the course of his wanderings, he visited all the gas-works in Queensland, as well as the principal ones in New South Wales and Victoria; eventually reaching Melbourne. When in Sydney, on his way south, he was offered, and has accepted, the position of Assistant Supervising Engineer in the Roads and Bridges Branch of the New South Wales Public Works Department—an appointment comprising the supervision and inspection of the bridge-building and road-making works carried out by the Government in and around Sydney.

Institution of Civil Engineers.—In view of the approaching re-opening of this Institution for the session of 1891-2, the Council have issued the usual circular setting forth the various premiums which they have power to award for approved papers, out of special funds bequeathed to them for the purpose, and inviting original communications on questions of professional interest. A list of subjects is given; and among those in which our readers are specially interested, we may mention the following: The design and construction of modern gas-holders of large size; the carburetting of gases for illuminating purposes; the technology of simple and carburetted water gas; the various systems of utilizing compressed air, water, and liquefied gases for motive power; the best arrangement of the engine for any given electric light station; methods for the prevention of the waste of water, and the detection thereof; and forms and the construction of masonry dams for reservoirs. The opening meeting for the ensuing session will be held on the 10th prox.

Cutler's Patent Shear-Legs.—We have received from Messrs. Samuel Cutler and Sons a photograph showing their patent self-contained shear-legs, as in operation at the Kensal Green station of The Gaslight and Coke Company, where the firm have erected a gasholder under the supervision of the Engineer of the station, Mr. A. C. M'Minn. Engineering readers will be aware that hitherto the shear-legs required for hoisting gas-holder columns have necessitated a cumbrous and dangerous system of guys to maintain them in position. Sometimes, where the space is limited, the disposition and anchoring of these guys have given much trouble, and contributed to delay the work in progress. To obviate this, Messrs. Cutler's device has been tried for the first time at Kensal Green, where it has been perfectly successful. It is essentially a simple arrangement. To the top of the usual vertical shear-legs standing outside the tank is attached a slanting light trussed stay, which is radial with the holder, and terminates in a moveable joint at the top of a short central post which can be carried upon the dome of the holder. The top of this post is guyed to points inside the ring of the tank—say, to the feet of the standards already erected, or to the holding-down bolts of others. In this way the principal part of the guying is confined within the tank area; only a light line or two being needed to steady the top of the shear-legs as they are walked round the tank. The arrangement will recommend itself in many situations.

NEW UNIONISM AND OLD ANARCHY.

It is fit matter for thankfulness on the part of all lovers of true Freedom, that the latest attempt of the New Unionist party to usurp control of the conditions of employment at the Thames-side wharves has not only been defeated by the Wharfingers, but has been defeated with comparative ease, and without any serious breach of the peace. Moreover, the circumstance that, in addition to encountering the opposition of the employers to their pretensions, these have been once more rejected by a majority of the class of men in whose interest they were ostensibly put forward, is enough to give pause to the leaders of the New Unionist faction, if these demagogues yet retain sufficient reason to be able to read a signpost labelled, "No Thoroughfare," when they find such a notice in their path. For really it is high time that the New Unionists recognized that wherever they have failed in the past—whether in Wapping or at the South Metropolitan Gas-Works, in Manchester or in Cardiff—their defeat has been due far more to the dogged perseverance of the working men who rejected their advice and set their threats at naught, than to the operations of those "capitalists," the employers, whose share in these industrial conflicts has been a much easier one to bear. The capitalist has spent his money, and planned the commissariat and other special arrangements necessitated by the abnormal conditions under which his work has had to be carried on, and he has co-operated with the duly appointed guardians of the public peace for ensuring the suppression of violence. Wherever the employer has fallen short of his duty in these regards, he has been overcome by the forces opposed to him, and has usually found defeat or surrender more costly than victory would have been. For this he does not deserve sympathy. But, unfortunately, when a private employer has been worsted in conflict with the forces of anarchy, the whole community suffers through him; and the general loss is then far more serious than any individual injury could possibly be. Regarded in its immediate aspect, it is a small matter whether an employer of labour has to pay a penny an hour more or less to his workpeople. The market value of labour is only one of the elements of trade which a merchant or manufacturer has to reckon with; and it is as little a matter of public concern whether he pays for it after one rate or another, as it is whether he lives up to his own income or saves any portion of it. When, however, the employer, small or great, is constrained by the forces of riot and anarchy to take any course with regard to his workmen which he would not willingly follow, a totally different aspect is imparted to the case; for every triumph of violence is an injury to the commonwealth.

It is the first lesson which the self-styled friends of the working man who organize strikes in his supposed interest require to learn, that violence is the worst weapon they can possibly use. The unsophisticated labourer, who is no stranger, in his own personal experiences, to the settlement of disputes by the ordeal of battle, is naturally prone to have recourse to the same remedy when acting in concert with his fellows against a common adversary. But, as we have had occasion to point out on previous occasions, this is a game that two sides can play at; and the workman is anything but the gainer when his employer, in default of satisfactory guarantees for the public security in the locality where his business is carried on, is driven to protect himself and his property by armed retainers. Some labour leaders in this country (to do them justice) have seen this point, and have learnt to discountenance violence on the part of their followers. That their advice on this head is not always taken by those to whom it is addressed, is doubtless due to the fact that the labourer, when in revolt, and with his passions raised, is apt to be more imprudent than those who—like Mr. Gilbert's Duke of Plaza-Toro—find it less exciting to lead their regiments from behind.

The circumstance that violence is seen to be a mistake by those labour leaders who have learnt the wisdom of peaceful methods of conducting industrial controversies, encourages the hope that they may in time set themselves to investigate the reasons for the cause of the failure of strikes which has already been given—the opposition of a majority of that very class of labourers which the strikes have been designed to benefit. Why is it that the New Unionism always breaks down before the resistance of workmen who will have nothing to do with it, but prefer to remain free from the domination of Unionist leaders? It is mere begging of the question to call these men "blacklegs," "knobsticks," and other names intended to bring their subjects into contempt. Abuse is not argument; and history is full of instances where the followers of causes once stigmatized by an opprobrious epithet—like the "Gueux" of the Low Countries—have turned the term into a badge of honour. Nor is it enough to imagine degrading and unworthy reasons for the actions of opponents whose steadfastness invariably leads them to victory when it is permitted free scope. It is absurd to suppose that the free labourers, who flock into wharves and gas-works at the invitation of employers who are strangers to them, and gladly take up work which others have thrown down at the bidding of outsiders with nothing to lose, are so inspired by sentimental regard for those employers as to be indifferent to their own interests. They are men to whom the pleas of Union organizers are as familiar as they are to those who have accepted them. Moreover, the pet theory of Union wire-pullers—that Free labour is always inferior to Union labour—is no longer tenable, after the revelations that have been made public with respect to the working of concerns that exhibit the influence of both. Why, in short, if the New Unionism is all that its partizans say it is, does it fail to command the allegiance, if not of all, of at least a reliable majority of the labouring population of this country? Why are the very men who are, in a general way, so enthusiastic in support of the theory that majorities must rule, so strangely driven, in their advocacy of the New Unionism, to sink the claims of the majority, and foist their own minority upon public attention as the only side worthy of respect?

We say that the reason is to be sought far deeper than the surface explanation, that New Unionism fails to make headway because it makes the mistakes of fighting upon wrong issues and defying economical laws. It owes many reverses to blunders of this kind. It has been routed whenever it has accepted battle with opponents who knew their own mind, and brought fair generalship to the support of their cause. But we should be the first to confess that if employers, in their resistance to the onslaughts of the New Unionism, had only their own cause to defend, neither their money nor their skill in using it would secure them safety in the long run. Their money would be useless if they could not get men to take it; but men do take the money, and we believe will continue to take it, notwithstanding all the fulminations and resolutions of Union leaders, for a reason that lies deep in the heart of that form of social life which is called Civilization. Whatever may be said to the contrary by our Social Democrats, we believe that the force of those motives and tendencies in mankind which make Civilization what it is, is very far from being spent. It is only in comparatively recent times that the community has learnt something of the nature of the working of the social organism. It does not know much about it, even now; and those of its members who are able to see furthest into the subject are the chariest of dogmatizing about it. At least, however, we know one thing: Great as Charles Darwin was, and magnificent as was his immediate contribution to the solution of the Problem of Humanity, he wrought greater than he knew. He opened men's eyes, and enabled them to see more than he could tell them; and if they can now learn anything at all of the workings of their own kind upon the earth, it is that the present condition of all living is due to Inequality—to essential differences in human endowments, powers, inclinations, and circumstances, which have rendered Competition the one law of life of which we can be most assured.

Now, what does Trades Unionism say to this discovery? In the so-called newer phase which it has assumed under the direction of agitators who were Socialists or Anarchists before they were labour leaders (Tom Mann told the Mayor of Hull the other day that there was a time when he was opposed to all authority), it has set itself to deny this law, and to require that civilized men, alone of all creatures in the world, and in their means of earning a livelihood, to the exception of all their other concerns of life, shall be laid under the burden of a paralyzing uniformity. In their dogged, dumb resistance to this chimerical condition of industrial existence, the free workmen of England are doing Civilization and the State more service than they know, or than we who watch the conflict can always realize.

How many times has the old catch-phrase, "Liberty, Equality, and Fraternity," been bandied about in the course of these labour agitations? Does anybody who reads these lines fail to perceive the essential antagonism of the meaning of the words of this portentous motto? What is Liberty, if it does not include freedom to rise to the fullest extent of one's powers and opportunities? Yet how is this rising to be reconciled with the maintenance of Equality; and what sort of Fraternity can there exist between the worker and the parasite, the producer and the destroyer, between him that buildeth up and him that scattereth abroad? "Before I can admit the plea of Fraternity," says Mr. Justice Stephen, "I must first know what manner of man it is that claims brotherhood with me;" and so say we all. Truly, men have been misled by many hollow and false phrases; but this phrase is one of the emptiest that ever deluded a careless world.

But, say the Socialist labour leaders, "We have a new gospel to proclaim—the gospel of the deliverance of the workers from poverty, to which wrongly-based social conventions have delivered them. The eight-hour day, municipal workshops, and the other panaceas of the New Unionist faith according to Mann, Tillett, Aveling, and Co., will secure this end." Will it? In the first place, is this truly a new remedy that is offered us for an old evil, which so suspiciously avoids mention of man's shortcomings as a possible cause of his misery? When the Labour Federationists last week, on the demonstration that their attempted "block" of the Thames-side wharves was a ludicrous failure, forthwith met and passed resolutions expressing their sense that the conflict should be carried on with "more energy," the pompous vagueness of the term irresistibly recalled a time and place when similar language was fashionable. This was the period of the French Revolution; and the place was Paris, where, owing to the abnegation of their rights and the neglect of their duties by the better orders of the nation, the scum and dregs of the community had it all their own way, until their Master arose. Readers of Taine and de Tocqueville will be familiar with the style of Mr. Clem. Edwards and

his associates; for it exactly reproduces that of the French revolutionaries who sat passing sonorous resolutions, while the mob were engaged in the Temple massacres. Nay, more, the very dreams of Mann and Tillett are the oldest of political nightmares. Before 1789 a M. Morelly drew up a Code of what he called Natural Laws, to which he proposed to make everybody conform—of course by main force. "Nothing in society shall belong in singular property to any one," says the first article of this Code. "Every citizen, is to be supported, maintained, and employed at the public expense," says the second article. "All productions are to be stored in public magazines, to be distributed to the citizens and to supply their daily wants, &c." Well may de Tocqueville remark that such a book might have been written yesterday. It is, in fact, coming out in weekly numbers at the present time, under the title of the *Trade Unionist;* yet it is more than a hundred years old. "Of all the men of their time," observes de Tocqueville, "these economists are those who would appear most at home in our own; their passion for equality is so strong, and their taste for freedom is so questionable, that one might fancy them our contemporaries." They do live among us in spirit, and they are enrolled among the stock London Company of Agitators.

Trades Unions, intelligently directed, might do great things for their members; but in most instances they have gone hopelessly wrong, because they have fallen under the domination of men who have known no better than to take old fallacies for new truths, who have mistaken the road to Anarchy for the path of Progress, and who have misunderstood the lesson of Civilization. On the other hand, the position that we have endeavoured to define and maintain in this article is that those who, whether as employers or as workmen, stoutly stand up for the freedom of the individual to do his business in his own way, champion the cause of Freedom as worthily as did their forefathers who in time past let the cry "Liberty, Equality, and Fraternity" go by like the idle wind, and braced themselves to stem the tyranny which followed in its wake.

DEATH OF MR. W. H. WILLIS.

It is with much regret that we have to record the death, on Wednesday morning last, of Mr. W. H. Willis, who for about forty years was connected with the Yarmouth Gas Company, and for many years was Secretary and Manager. His death occurred in a very sad and sudden manner while travelling by train from Blackheath to King's Cross, London. Mr. Willis retired from his managerial duties about a year or two ago, and had for some time past been in an ailing state of health, as he suffered from a brain malady, which necessitated rest and change. He had, we believe, been on the Continent and at Brighton, and was with a friend at the time of his death. The deceased was universally respected. He was a widower—his wife dying a few years ago; and he leaves no family. We understand that Mr. Willis and the friend with whom he was staying at Blackheath (Mr. Samuel Cutler) hurried to the station to catch the train for King's Cross, and that deceased had no sooner taken his seat in the carriage than he was suddenly seized with illness and expired.

The following interesting notice of the deceased gentleman has appeared in one of the local papers:

Mr. Willis was a native of Yarmouth; being born here May 3, 1829. Upon leaving school, he went to sea for a short time; subsequently entering the office of the Gas Company, where, under the direction of Mr. Church, the then Secretary, he developed a great aptitude for business. In those days, the manufacture of gas was carried on in a necessarily limited manner. The office was in Middlegate Street, and the works on the South Denes were very insignificant, as compared with the present extensive premises. On the death of Mr. Church, Mr. Willis succeeded him as Secretary—a position he continued to hold for about 45 years. It was his earnest desire to have the opportunity of celebrating his jubilee in the service of the Company. Failing health, however, disappointed this wish. After many resolute struggles to continue his work, he was compelled to retire. The Directors recognized his valuable labours on their behalf by many acts of kindness; and, in addition, awarded him a suitable pension. His resignation was a cause of keen regret to his colleagues in the office, and evoked widespread sympathy among his fellow-townsmen. In private life his qualities of head and heart were so infused with a spirit of human gentleness, as to inspire feelings of affectionate regard. He was kindness itself; and not a few cherish vivid remembrances of his sympathetic speech and generous help. He was devotedly attached to his profession; and the result of his diligence appeared in the admirable management of the office and in the striking improvements at the works. He possessed accomplishments of no mean order. He was a clever musician and a skilful artist. Indeed, had he cultivated his artistic gift, there is no reason for doubting that he would have taken a high place as a caricaturist. His sketches were full of talent, enhanced by the presence of a joyous humour, which merrily laughed over the foible or eccentricity he so aptly portrayed. His taste for scientific pursuits was exemplified by his studies with the microscope. It will thus be readily understood that Mr. Willis became the centre of a large circle of admiring and affectionate friends, to whom the news of his sudden death was a great shock. Thus another gap is made in the ranks of the men who, in various ways, have, by industry, raised themselves to positions of honourable usefulness in our town. Endowed with gifts above the average, and possessing a most loveable disposition, our late friend leaves behind him memories, luminous with the kindly light of a true brotherly affection.

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART I.—THEORY.

(*Continued from p.* 664.)

It is impossible to enter fully into the study of lighting without referring to its physiological side. This branch of the question is expressed by the term *perception*, which refers to the subjective effect produced on the observer by the exhibition of light to his organs of vision. Much of what has already been laid down in this presentment of the subject—such as the laws of Kepler—does not depend upon the ocular perceptions of the observer. These laws are mathematically demonstrable as results of the Undulatory Theory; and the "law of intensity" is as applicable to Heat and the Force of Gravitation as to Light. It would be to take a blind man's view of the problem of lighting if influences which the observer contributes to the effect were to be ignored. The laws of Vision have quite as much to do with the reality of Lighting as have the fundamental laws of the Undulatory Forces. The notion of *brightness* in connection with lights and lighting is purely physiological in its origin, affected, as in practice the observation of lights is, by the phenomena of irradiation. It is for this reason that no mechanical or automatic system of photometry is possible, so long as the human eye remains the ultimate means of judging lighting effects. Light is not merely a mode of motion, and, as such, capable of being reported by physical instruments; it is also the servant of human vision. Consequently physiological considerations must enter into all discussions of the quantity and quality of lights.

It is desirable, for a complete study of this side of the subject, that the process of vision should be investigated. It is hardly necessary, however, that this branch of the general question should be specially treated here, since every good text-book of Optics contains a chapter on the eye as an optical instrument; and it is only necessary to recommend the student to obtain, from some such source, an intelligent idea of the action of the human eye under the stimulating effect of light. We will therefore proceed to discuss these effects quantitatively; taking the *modus operandi* of light upon the human eye as being, for all practical purposes, understood.

Lardner remarks, on the subject of the sufficiency of illumination, that it is not enough for distinct vision that a well-defined picture of the object shall be formed on the retina. This picture must be sufficiently illuminated to affect the senses, and at the same time not so intensely illuminated as to overpower the organ. Thus it is possible to conceive a picture on the retina so extremely faint as to be insufficient to produce sensation; or, on the other hand, so intensely brilliant as to dazzle the eye, to destroy the distinctness of sense, and to produce pain. (This is an observation that seemed to be altogether forgotten when electric arc lamps first came into general use.) The effects of direct sunlight and of the light of invisible stars are cited to show that both too much and too little light are obnoxious to vision. The eye possesses a certain limited power of accommodating itself to various degrees of illumination—a power which is exercised upon passing from a light room into a dark one, and contrariwise. The exercise of this power of accommodation is complicated, upon occasion, by the paralyzing effect of an extremely brilliant light upon the organ of vision, in which cases a longer time is required for the recovery by the eye, in semi-obscurity, of the visual acuity which it had possessed before it was stunned, so to speak, by excess of light.

Although the power of the human eye to accommodate itself to varying degrees of illumination is rightly described as limited, since it is not infinite, the range of this accommodation is actually very great. In other words, the human eye can work more or less to the satisfaction of its owner through a very wide range of illumination. In point of fact, it has to do so. There are some things which the eye can only do in bright sunlight; but there are more which it can do in comparative shade. For many purposes of vision, moonlight is sufficient; others can be served by starlight; and so we might range through the various intensities of artificial lighting, from that of the naked electric arc down to that of the horn lantern. Yet what a range of lighting is here expressed! According to Wollaston, the mean brightness of sunlight is 800,000 times greater than that of the full moon; while the light of Sirius, the brightest of the fixed stars, is only the 7000th part as bright as the moon. These proportional estimates have been reduced to concrete expressions. Bouguer and Wollaston both tried to compare the light of the sun with that of the full moon, and to express the result of their measurement in candles. They both found that the sun's light was equal to that of about 5600 candies placed at a distance of 30 centimetres. Wollaston determined the power of full moonlight to be equal to 1-144th of a candle at a distance of 3·65 metres. Another determination fixes the light of the sun at 600,000 times that of the moon, or as equivalent to the light of 5500 candles at a distance of 12 inches.

The limitation of the power of accommodation of the eye appears most conspicuously when it is attempted to see, as the popular expression runs, "between the lights." Bouguer ascertained, by a simple photometrical experiment, that one light, of whatever intensity, is not perceptible to our eyes in presence of a light 64 times brighter. This explains how it is that artificial

lights are of no use to us in daylight; and why we cannot see the stars at clear noonday, nor distinguish from within anything through the windows of a well-lighted room at night. It seems to be a fair inference from this observation that no scheme of artificial lighting is to be regarded as satisfactory (excepting as regards beacons) where any part of the illuminated area receives 64 times more light than any other part. The acuity of the eye to variations of illumination is a complementary determination to that just given. It has been ascertained that a difference in strength of light or shadow of 59-60ths is perceptible by the normal eye.

Remark has already been made upon the physiological notion of *brightness*, which enters largely into the problem of lighting. Lardner observes that, according to the accepted law of radiation, if two points from which light radiates be placed at the same distance from the eye, the brightness of their image on the retina will be in proportion to their absolute brilliancy. But if either point be removed to a greater distance, the number of rays passing from it which enter the pupil will be diminished in the same proportion as the square of its distance is increased, and *vice versâ*. It consequently follows that the brightness of each point of the image of an object formed upon the retina, will be in the direct proportion of the absolute brilliancy of such point, and in the inverse proportion of the square of its distance from the eye. Thus, if I express the intensity of the light of the point upon the object, and D its distance from the eye, then the brightness of the image of such point upon the retina will be expressed by $\frac{I}{D^2}$. It is, therefore, clear that the brightness of the image of each point of an object will be diminished as the square of the distance of the object from the eye is increased. It might be inferred from this deduction, though erroneously, that the apparent brilliancy of the image of a visible object decreases with the square of the increase of its distance. This would be the case if, while being withdrawn farther from the eye, the image of the object on the retina continued of the same magnitude. But it must be considered that, as the object retires from the eye, the superficial magnitude of the image on the retina is diminished in the same proportion as the square of the distance of the object from the eye is increased. "It, therefore, follows that while the points composing the image on the retina are diminished in the intensity of their illumination, they are collected into a smaller space; so that what each point of the image on the retina loses in splendour, the entire image gains by concentration."

Important practical consequences follow from these principles, especially in regard to the appreciation by the eye of lights intended for use as beacons, by being visible themselves rather than rendering other objects visible in their rays. Thus, when the light of a luminous object has a certain intensity, it will continue to affect the retina in an appreciable manner, even when the object has been removed to such a distance that the visual angle which it subtends ceases to have any perceptible magnitude. The fixed stars present examples of this. None of these objects has any sensible magnitude. When viewed through the most perfect telescope, they appear merely as brilliant points. In this case, therefore, the eye is affected by the light alone, and not by the magnitude of the object seen. Nevertheless, the distance of such an object may be so increased that its light will cease to produce a sensible effect upon the retina. Observation from a distance of the street lights of a town will supply many illustrations of this principle.

Professor Tait, in his article on "Light" in the Encyclopedia Britannica, deals with the same aspect of the question of illumination; drawing out the proposition that "the apparent brightness of a luminous surface (seen though a transparent homogeneous medium) is the same at all distances" as a corollary from the Keplerian law. He goes on to observe that the important fact connected with the subject (already mentioned) is that "the brightness of a self-luminous surface does not depend upon its inclination to the line of sight." Thus a red-hot ball of iron, free from scales of oxide, &c., appears flat in the dark; so also the sun, seen through mist, appears as a flat disc. Professor Tait also states the law in another form, as follows:

> The amount of radiation, in any direction, from a luminous surface is proportional to the cosine of the obliquity.

The flow of light (if we may so call it) in straight lines from the luminous point, with constant velocity, leads, as we have seen, to the expression $\frac{\mu}{r^2}$ (where r is the distance from the luminous point) for the quantity of light which passes through unit of surface perpendicular to the ray in unit of time, μ being a quantity indicating the rate at which light is emitted by the source. This represents the illumination of the surface on which it falls. The flow through the unit of surface whose normal is inclined at an angle θ to the ray is, of course—

$$\frac{\mu}{r^2} \cos.\ \theta\ ;$$

again representing the illumination. These are precisely the expressions for the gravitation force exerted by a particle of mass μ on a unit of matter at distance r, and for its resolved part in a given direction. Hence we may employ an expression

$$V = \Sigma \frac{\mu}{r},$$

which is exactly analogous to the gravitation or electric potential, for the purpose of calculating the effect due to any number of *separate* sources of light. And the fundamental proposition in potentials—viz., that if u be the external normal at any point of a closed surface, the integral

$$\iint \frac{d\,V}{d\,n}\, d\,S,$$

taken over the whole surface, has the value

$$-4\,\pi\,\mu_0,$$

where μ_0 is the sum of the values of μ for each source lying *within* the surface, follows almost intuitively from the mere consideration of what it means as regards light. For every source *external* to the closed surface sends in light which goes out again. But the light from an internal source goes wholly out; and the amount per second from each unit source is 4π, the total area of the unit sphere surrounding the source. It is well to observe, however, that the analogy is not quite complete. To make it so, all the sources must lie on the same side of the surface whose illumination we are dealing with. This is due to the fact that, in order that a surface may be illuminated at all, it must be capable of *scattering* light—*i.e.*, it must be to some extent opaque. Hence the illumination depends mainly upon those sources which are on the same side as that from which it is regarded. . . . There is a curious reciprocity in formulæ such as we have just given. For instance, it is easily seen that the light *received from* a uniformly illuminated surface is represented by

$$\iint \frac{d\,S \cos.\ \theta}{r^2}.$$

As we have seen that this integral vanishes for a closed surface which has no source inside, its value is the same for all shells of equal uniform brightness whose edges lie on the same cone.

This is as far as we need go into the mathematical bases of calculation for the ordinary problems of illumination. Lighting, however, as Professor Tait admits, is only easy of measurement according to the principles of the undulating theory, when the two qualities of the light furnished by different sources between which a comparison is to be made are identical. When we endeavour to compare differently coloured lights, the result is by no means so satisfactory. Here the physiological element again comes into play, and vitiates the results of merely dynamical definition.

The only matter that remains to be dealt with in this division of the subject, and that cursorily, is the phenomenon of *irradiation*, which is the appearance of lights at a distance from the observe as being larger than they really are. The stars are the most notable example of the effect of irradiation; but distant street gas-lamps exhibit the same phenomenon, which, up to a certain limit, compensates for the absorption of light by the atmosphere. This is, of course, a different phenomenon from the lighting of halos of misty air by artificial light-sources, which is likewise a consideration possessing practical importance. Irradiation, it may be observed, is by no means confined to the appearance of distant lights; it is by it that "a candle or gas flame appears continuous, though its incandescent particles are by no means in contact with one another; and the glowing filament of an electric incandescent lamp appears much thicker than it really s." (Daniell.)

(*To be continued.*)

The Bursting of the South Fork Dam.—The last volume of the Transactions of the American Society of Civil Engineers contains the report of a Committee appointed by the Society to investigate the cause of failure of the South Fork Dam, which took place in June, 1889, and caused a terrible loss of life and property at Johnstown. From this report, it appears that the dam was commenced in 1839; being built to the order of the Central Commissioners of the State of Pennsylvania. The material consisted partly of earth and partly of stone; the slopes being 2 to 1 in the up-stream side, and 1½ to 1 on the down-stream side. The width of the dam was, as originally constructed, 10 feet at the top; but the crest was afterwards lowered, so as to afford room for a roadway across it. The width at the bottom was 200 feet. Its height was about 70 feet; and the bulk of water impounded, upwards of 500 million cubic feet. The waste-water weir had an effective width of about 70 feet; and the water would flow over it to a depth of about 8 feet before imperilling the dam. At the time of the disaster, very heavy rains had been falling in the district; and the quantity of water entering the reservoir was about 10,000 cubic feet per second, to discharge which the flow over the spill-way should have been about 12·63 feet thick. In 1862 trouble had arisen from leaks in a culvert passing through the bottom of the dam, which finally resulted in a breach, which was repaired by the South Fork Fishing Club, who closed the openings through the bottom of the dam, so that in case of emergency all the surplus water had to be discharged by the waste weir. These openings consisted of five 24-inch pipes, which, discharging under a head of 70 feet, would have materially relieved the spill-way if they had been available at the time of the disaster. The breach through the dam is 420 feet wide; and the amount of material removed was 90,000 cubic yards. The Committee attribute the disaster entirely to insufficient length of spill-way, which was only one-half of that originally intended by the Engineer. Inspection of the dam showed careful workmanship and sound material. The destruction of property by the flood is estimated by the Committee at between $3,000,000 and $4,000,000; while the most careful estimates put the loss of life at about 2500. This figure is only about one-fourth of the original estimates.

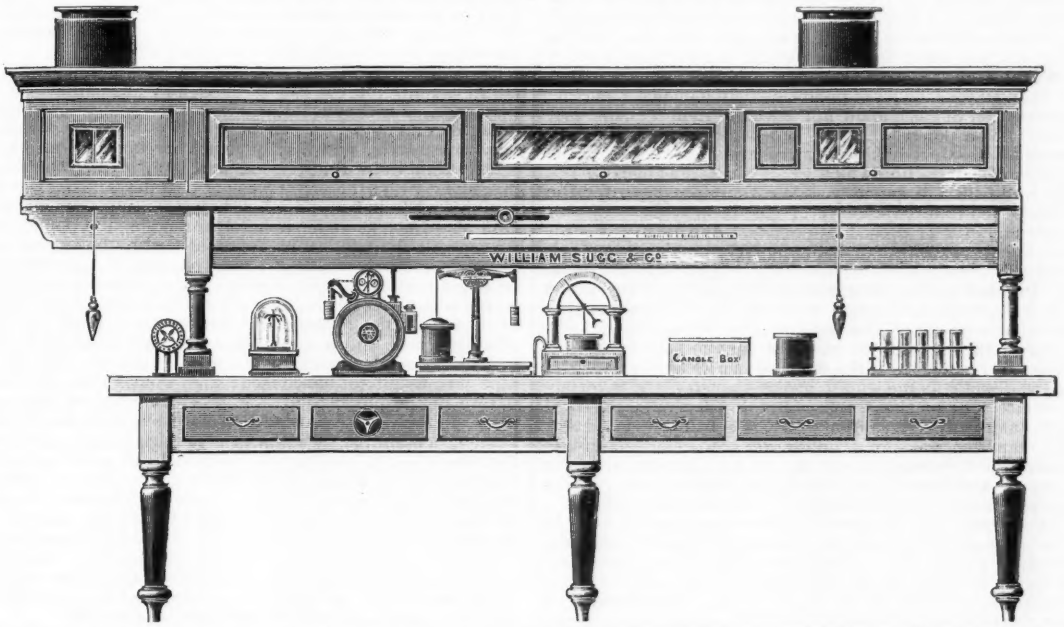
TECHNICAL RECORD.

THE STANDARDS DEPARTMENT AND THE VERIFICATION OF PHOTOMETERS.

We have received from Mr. William Sugg the accompanying illustration of the standard Evans photometer as approved and stamped by the Standards Department of the Board of Trade, in accordance with the Memorandum issued a few months ago, and noticed in the JOURNAL for the 11th of August last. As mentioned in our editorial columns to-day, this instrument, as passed by the Department, is the only legal form of Evans photometer available for the use of companies working under the Gas-Works Clauses Act. Already two of them, with their apparatus complete, have been stamped—one for the Brentford, and the other for the Godalming Gas Company. Mr. Sugg has kindly furnished the following particulars as to the construction of the photometer:—

The scale of the instrument is 100 inches from end to end; and the lights to be compared are fixed at the above distance apart. The disc is made to move, and is observed through the glass door. The readings are taken from a scale which is fixed under the photometers, as shown in the illustration. The positions of the lights to be compared are indicated by the plumb-lines, which cut the centres of the flames; and each end door is provided with a coloured glass, so that the flames of both gas and candles, or other standard light, can be seen at any time during the course of the observations. The moving of the disc is effected by turning the knob which is shown just below the glass door in the middle of the photometer. Any of the standard 2, 10, or 16 pentane Argands can be used in the instrument, as well as the candle-balance and candles, by simply substituting one for the other; or the Methven screen can be employed instead of any of these. The arrangement of the photometer follows that of those photometers, under the jurisdiction of the Gas Referees, used in the testing-places in Cloth Fair, Fenchurch Street, and Dorset Buildings, all in the City. The scale of these photometers is, however, only 60 inches. The lights are perfectly steady, and the instrument is convenient. It can be used in any well-ventilated room not less than 12 ft. by 10 ft., and 10 ft. high, without the necessity of blackening the walls; being complete in itself, and forming its own dark chamber. Every photometer that has been stamped must have a brass plate affixed to the bench top, bearing the name of the photometer—"Evans" or "Letheby"—and the length of the scale. Beneath this the name of the company or corporation to whom it belongs, the name of the engineer for the year in which it was stamped, and the year, followed by the maker's name. The seals of the Standards Department are on either side of this plate; and they are affixed in such a way that the plate cannot be removed without breaking them.

The form of Letheby photometer to be used under the Gas-Works Clauses Act has also been settled; and one has already been stamped for the Leighton Buzzard Gas Company. Mr. Sugg promises to send next week a drawing and description of the approved instrument.



THE DISTRIBUTION OF ENERGY BY GAS.

In view of the interest attaching to the scheme of the Cork Gas Company for supplying electric light from gas-engine sub-stations, to which reference has been made on two recent occasions in the JOURNAL, we reproduce the following article, contributed by Mr. Denny Lane to the *Electrician*:—

There was a time when the proprietors of gas-works were so much alarmed by the advent of the electric light, that they parted with their shares at a heavy loss. Experience has proved that their fears were ungrounded; and, in fact, the consumption of gas has increased more rapidly in the last decade than it had in any previous period. The very stir that was caused by the threatened competition roused the energies of gas engineers, who were waxing fat, and perhaps growing lazy, after many years of unbroken prosperity. I always alleged that the electric light would never injure the shareholders in gas companies; on the contrary, it has conferred benefits on them, which may, in my opinion, be considerably increased. As I have devoted a good deal of time and thought to the connection between gas and electricity, I will endeavour to point out a mode by which each may be made to help the other. A celebrated old theological treatise is called "*Concordantia Discordantium Canonum*." In the same spirit, I would wish to evoke harmony out of the discord which is supposed to exist between these two brilliant rivals.

The subject naturally divides itself into three heads—the generation, the storeage, and the distribution of the agents to be employed.

With respect to generation of illuminating gas, there is not much hope for any substantial improvement. The practice of three-quarters of a century has naturally developed highly an industry which yields residuals that return a large proportion of the first cost of the raw material. I believe that the cost of labour in gas making will certainly be reduced to the extent of 2d. or 3d. per 1000 cubic feet; but beyond this I see no probability of further economy. With reference to heating gas, it is, however, a different question. I believe such gas can be produced at a price lower than that of 16-candle gas; but, of course, it would require separate mains.

With respect to the generation of electricity from motive power, we cannot hope for any improvement. With the many admirable dynamos of all kinds which are now procurable, it is a proud thing for electricans to say that they have left no room for improvement. When dynamos convert from 90 to 95 per cent. of mechanical into electrical energy, they have far exceeded the results obtained in every other analogous transformation, and by so doing have endowed their favourite science with one of the brightest of the jewels that adorn her crown.

Next, as to storeage. The gas engineers have this immense advantage, that their hourly production need not be more than the *average* demand of 24 hours of mid-winter, while the electrician who does not use storeage cells must have producing power sufficient to meet the heaviest hour, or, in fact, *minute* in the year, although that may require five or perhaps ten times the average consumption. On the other hand, if he employs accumulators, he has to meet a heavy first cost and a depreciation which, with a fair interest on capital, will run up to 15 or 20 per cent. per annum. Nevertheless, I believe that for those hours (and in summer they are long ones) in which the demand for light is low, great economy will result from the partial employment of these most useful garners of energy.

The third point to be looked into is distribution; and when I

first worked out the problem, I own I was surprised at the low cost of the distribution by means of gas supplied to gas-engines. My surprise was increased and confirmed lately on reading the excellent lectures which Mr. Kapp has delivered on the transmission of energy. I saw more clearly than before the great losses incurred by the transfer of energy in every other case except that furnished by gas-mains. In many cases the existing mains are capable of transmitting as much gas as would in all probability be required for electric lighting at present prices. I think it fairer, however, to calculate what would be the expense of separate mains laid to supply electric sub-stations. I do so for four reasons: (1) Because this gives the total cost of distribution. (2) Because it gives an opportunity of supplying cheap gas of good heating, but low illuminating power, which might also be used for stoves and cooking. (3) Because it affords the means of increasing the supply of gas as the demand for electricity increases, without throwing undue pressure on the service-pipes of ordinary consumers. (4) Because the unaccounted-for gas would be very small. In fact, gas companies get paid for what is delivered at the consumer's meter—a quantity considerably less than that supplied at the inlet of the distributing-mains. But the loss can easily be accounted for by minute leakages in the innumerable joints of the service-pipes and connections to the meter—each small in itself, but, when multiplied by myriads, making up an important aggregate. With a good main, carefully laid, and not tapped for services, the leakage would be small, and should not amount to 1 per cent. of the quantity delivered. In such a case, the pressure can be increased considerably without causing any notable loss, or any inconvenience to ordinary consumers.

Of course, gas will not travel through a main without some propelling force; but the amount required is extremely small, as may be judged from the following example: As water weighs about 62½ lbs. per cubic foot, the weight of a column of water of 1 foot area and 4 inches deep is under 21 lbs. This gives what is called "four inches of pressure." In a good gas-engine, the consumption of gas should not be more than 24 cubic feet per brake horse power when at full work; but I will allow one-fourth more—thus making a more ample provision for the extra proportion of friction which exists when the engine is not working up to its full capacity. We therefore have for the power employed to force enough of gas through the mains for 1-horse power, $30 \times 21 = 630$ foot-pounds. As a horse power for one hour means $(33{,}000 \times 60)$ 1,980,000 foot-pounds, our propelling power is only $1{,}980{,}000 \div 630$, or the 1-3143rd part of a horse power. In other words, 1-horse power employed at the works would force through the mains as much gas as would supply over 3000-horse power at 4 inches difference of pressure.

Of course, the quantity of gas that can be sent through a main depends on the size of the main and on its length; varying in practice directly as the square of the diameter, and inversely as the square root of the length. But I will give a practical example; taking my figures from "Barlow's Tables." I find that a 6-inch main one mile long will deliver 9000 cubic feet of gas per hour at the difference of pressure of 4 inches, which I have given above; and if we divide this by 30 cubic feet, we get 300-horse power delivered at this moderate difference of pressure.

Let us see now what the cost of such a main would be. At £5 a ton (in many places the price is less), a 6-inch main costs 4s. a yard, or £352 a mile. If with turned and bored joints, the cost of laying would be 1s. 6d. a yard in a paved road, or £132; making in all £486—let us say £500—a mile. The interest on this at 5 per cent. would be £25, or 1s. 8d. per horse power per annum. If, however, the pressure were increased to 16 inches, double the quantity of gas would be delivered, while the motive power absorbed would be considerably under 1-horse power at the time of the maximum delivery of 600-horse power for one mile. I believe no other instance can be given of so moderate a cost for the transference of energy. Counting the cost of gas at 2s. 6d., we have in the first case 300-horse power transferred one mile by the expenditure of $300/3000 = 0{\cdot}1$-horse power or 0·1d. In the second case, we have 600-horse power carried a mile at a cost less than ¼d. But besides this remarkable economy, we have also the following advantages: The cartage of coal to, and of ashes from, a station is done away with. No nuisance is caused by the escape of smoke or of steam; and, if the foundations are properly arranged, and the base of the engines isolated from the surface of the ground, no damage will be caused by vibration. The whole space occupied by boilers will be saved; and, where the space is of value, a building of three floors—the two lower containing gas-engines and dynamos, and the upper storey giving room for attendants and regulating gear—can be employed.

But, again, a most important saving would be made in attendance. Practically a good gas-engine requires no continuous attendance. A daily supply of oil, and an inspection which need occupy only a quarter of an hour, are all that is necessary. I can say this from several years' experience. Formerly there was some difficulty in starting gas-engines. Now several contrivances enable this to be effected without any trouble. Again, the wear and tear of gas-engines is extremely small. At works here [Cork], a small engine has run for upwards of 56,000 hours. At the end of that time, it required a new lining to the cylinder, which cost 2½ per cent. of the first cost of the engine. The slide-valve required to be scraped occasionally; but the slide-valve has been dispensed with in engines of modern make. This engine, although working continuously night and day, is looked to only twice in the 24 hours, in order to give a supply of oil, and take the index of the meter. It is working in a yard where it is exposed to some extent to the dust of coke—one of the most active grinding materials we know; and but for this, it is probable the cylinder lining would have lasted longer. Now, if a station is supplied with a small proportion of storeage cells, I think I may assume that the dynamos will not be required for more than five hours a day on an average—say, 1800 hours a year. If my data therefore be correct, a gas-engine should work for 20 years, and then may require a new cylinder lining, which would come to 2½ per cent. of the first cost. To this must be added the insignificant cost of new piston-rings required occasionally.*

Compare this with the wear, tear, and maintenance of steam-engines, remember the wages of stokers and engineers, and I think a remarkable economy in the up-keep and attendance of the gas motor must be admitted. Again, with the best boilers, it takes a considerabie time to get up steam; and in work necessarily intermittent, the heat accumulated in the boiler and setting is wasted. We are thus burning the candle at both ends *without deriving any light from it*. It is this cause which runs up the cost of coal for electric light stations so very high. Dr. Fleming estimates it at from 9 to 22 lbs. per unit sold. In one case in the North of England, I find the consumption is 23·4 lbs. per unit. On the other hand, a gas-engine can be started in less than a quarter of a minute; and as soon as it is stopped, all consumption of fuel ceases. Hence its great economy whenever the demand for power is intermittent. Next as to the chance of breakdown or interruption. The steam-engine and boiler form a very complex arrangement. If any serious injury to any of the essential parts takes place, the whole system is made inoperative; and in most cases the boiler must be stopped occasionally for cleaning, examination, and repairs. On the contrary, the gas-engine is extremely simple in construction.

Of course, "accidents will happen in a family as well regulated" as that of the gas-engines; but, fortunately, these are very rare. I will conclude by giving a singular example. At a large printing establishment in Cork, a gas-engine worked very irregularly, and finally struck work. Messengers were sent to complain "that the gas was bad," "that there was no pressure," "that the meter was out of order," "that the service was choked"—in fact, the whole litany of complaints was recited. One of our engineers immediately attended, and found nothing wrong with the supply, or apparently with the engine, which, however, refused "to do a stroke of work." On examination, he found that the supply of air to the engine was derived from a pipe which was carried up outside the building to a height of about 8 feet; the object of this arrangement being to take air at a high level, and so avoid dust, &c., which might be drawn in and injure the cylinder, piston, and valves. This air-inlet pipe was found to be choked; and what, think you, was the nature of the obstruction? It was composed of *thirteen boys' caps*. In fact, there is a school close by; and the Cork boy, being of a scientific, ingenious, and inquiring disposition, noticed that there was a considerable in-draught at each inspiration of the engine, and having been taught that "Nature abhorred a vacuum," he endeavoured to secure a "plenum" by tossing another boy's cap close to the end of the pipe, where it performed the pleasing conjuror's trick of suddenly vanishing. Of course, the other boy returned the compliment; and so it went on, and would have gone on, until all the caps of the school were absorbed, were it not that the air fiend got so gorged that he lost all appetite, and "died of shortness of breath."

You will, of course, notice that I have said nothing of the cost of gas used in gas motors; but as this communication is already too long, I will, with your permission, reserve my remarks on this subject for another occasion. I have only dealt with the distribution through feeders. The present practice seems to depend on distributing from sub-stations at a low pressure, whether the alternating or the continuous current be employed. Of course, the system I advocate dispenses with banked transformers, and would probably use storeage cells for a certain portion of the delivery, although equally well adapted for the alternating current.

Imperial Continental Gas Association.—The Directors of this Association recommend a dividend of 5 per cent. and a bonus of 1 per cent., both free of income-tax, for the half year ending June 30 last.

Death of Mr. Peter Low.—We regret to record the death, on the 8th inst., at the comparatively early age of 51, of Mr. Peter Low, Chief Foreman of Mains for the Central Division of The Gaslight and Coke Company—a position he had filled for many years. The deceased was well known in North and Central London, as well as in the City; and the great respect in which he was held was testified by the number of his intimate friends and colleagues in the Company's service who attended his funeral, which took place at Chingford Mount Cemetery last Wednesday. Representatives of all classes of the officers and workmen were present, from the chief of the division (Mr. S. J. Ball) downwards; for Mr. Low was a general favourite, and an upright, just, and valued servant. His premature removal has excited much sympathy for his widow and family.

*I have just heard of a case where a gas-engine has been running 168 hours a week for 11 years, without any renewal of cylinder lining or of piston. The last piston-rings were put in three years ago.

IRON AND STEEL INSTITUTE.

The Autumn Meeting of this Institute was held at the Institution of Civil Engineers on the 8th inst. and the following day, under the presidency of Sir FREDERICK ABEL, K.C.B., D.C.L. The proceedings were not of special interest to our readers; but some of the papers presented were on subjects which will justify notice in the JOURNAL.

The first paper was by Sir H. Bessemer, F.R.S., describing an invention for the manufacture of continuous sheets of malleable iron and steel direct from fluid metal. He reminded the Institute that in August, 1856, he first announced to the world that malleable iron in a molten state could be produced rapidly and in large quantities. He had at once endeavoured to avail himself of the advantages which this novel condition of fluidity presented; and, reverting to his former inventions for rolling fluid lead and glass into continuous sheets, he grasped the idea that malleable iron or steel could be thus made, not only into sheets and plates, but also into thin bars or rods, by passing the fluid iron in between a pair of rolls placed in the same horizontal plane. Accordingly, he carried out some experiments on the subject. After melting and decarbonizing 6 or 8 lbs. of pig iron in a common 20-lb. crucible, he endeavoured to get it to the rolls before it had assumed the solid form. After several attempts, he succeeded in doing this, and in producing a thin sheet some 3 or 4 feet in length. This sheet had a clear surface, and was almost wholly free from oxidation, and absolutely free from scale. It was as tough as any rolled iron plate he had ever seen; and it left no doubt in his mind of the entire success of this system of rolling thin sheets direct from fluid metal. He immediately patented the invention, notwithstanding that the Bessemer process was then regarded by the trade generally as an absolute failure; but the whole scheme for the production of continuous sheets direct from fluid iron was "simply pooh-poohed and laid aside, without any serious consideration of its merits," by the tin-plate manufacturers of that day. Having described the original form of his apparatus, and the manner in which he proposed to remedy its defects, Sir H. Bessemer concluded his paper as follows: With reference to the speed of production, let us assume the mill to be fitted with a pair of 4 feet diameter rolls, 18 inches wide, and making four revolutions per minute, and set to produce a sheet having an initial thickness of 1-10th of an inch, and rolled by the third pair to 1-20th of an inch, we should thus have a surface velocity of the first pair of rolls equal to 50 feet per minute, and making, when finished, 100 plates, 18 in. by 12 in., 1-20th of an inch thick, and weighing 300 lbs., or equal to a production of one ton of plates in 7½ minutes. Hence it becomes a question which is the least costly mode of dealing with a ladleful of fluid steel—forming it into massive ingots in moulds, or making it into thin sheets in the manner proposed?

Mr. F. J. R. Carulla, of Derby, read a paper on an undescribed phenomenon in the fusion of mild steel, which he thought might throw some light upon the discrepancies in regard to the melting-points of certain iron and aluminium alloys, which had been noted by different observers. He said the phenomenon in question was the remarkable one that the interior of a piece of mild steel might be raised to the fusing-point while the outside remained in a solid state. After describing the circumstances under which he had observed this, Mr. Carulla pointed out that the greater fusibility of the interior of a mild steel bar, as compared with its exterior portion, would assist operations in the system of manufacturing Mannesmann tubes, which was described in the JOURNAL for June 3 last year (p. 1028). In conclusion, he said that, without asserting that the phenomenon in question played an important part in the process, it was certainly interesting to note that, as the interior of the bar must be in a more "pasty" condition than the outside, being nearer its melting-point, the circumstance, if not actually conducive to the production of a hollow centre, would at any rate offer little opposition to the forces that induce its formation.

A paper was read by Herr J. Massenez, showing the results which had been obtained from plant erected at the Hoerde Works for the elimination of sulphur from pig iron. Before giving the figures, the author said that the question of desulphurization had especially of late years, become of the utmost importance, at any rate for the iron industry of the Continent. By the great strike of 1889, the German colliers succeeded in greatly improving their wages; and with this increase in pay, it seems that not only is there a distinct diminution in the quantity of coal wrought, but, unfortunately, what has been produced since then is raised in a much less pure condition than was formerly the case. Consequently, the proportion of sulphur in the coke has considerably increased. Whereas formerly this did not exceed 1 per cent., it has now in many cases risen to 1·8 per cent.; so that an unpleasant ratio exists between the wages of the workmen and the amount of sulphur in the coal raised. By the method of desulphurization adopted at Hoerde, the author claimed that there is a saving of coke, and a certainty that no "red-short" charges are obtained in the treatment in the converter; while the pig-iron passes to the converter at a suitable temperature. The author considered that the great convenience and certainty presented by this method would in all probability lead to its general adoption.

A paper was read by the Secretary (Mr. J. S. Jeans), on behalf of Mr. B. H. Thwaite, C.E., of Liverpool, descriptive of the plant in the Metallurgic Department of the Sheffield Technical School, to which the author accorded very high praise—claiming it as an instance in which this country had entirely eclipsed the Continental *écoles techniques*. With regard to the plant for the production of gaseous fuel, the author said the aim in designing it had been to provide means for generating the various characters of useful combustible gases from solid and liquid hydrocarbons, so that the student might be able to study the respective advantages and disadvantages of each chemically, thermically, and economically. The plant will also serve to demonstrate the practical, chemical, and physical actions involved in the cycles of production. It will permit the following combustible gases to be generated: (1) Water gas; (2) oil-enriched water gas; (3) oil gas; and (4) carbon monoxide, or ordinary producer gas; and any mixture of these gases. The gaseous fuel generated is available for use in the steel-furnace for heating the ingot moulds in the casting-pots; and it can also be taken off for calorimetric estimation. The water gas and the carbon monoxide gas can also be stored in the holder for comparative tests when used in the gas-engine. In the plant for generating water gas, the process of production is the usual one. High-pressure steam is introduced into the fuel, and, passing through it, is converted in combination with the fuel, and by a well-known series of reactions, into hydrocarbon monoxide. In blowing up the fuel, either air from the air-pressure mains is turned into the fuel by a valve, or the air is injected by steam, from which it is separated in passing through a condenser. The water of condensation being returned to the steam-boiler, this is a very efficient and simple method of inducing a flow of air against a moderate head of contra-pressure, and it satisfies a high standard of thermo-dynamic efficiency. By a regulation of the valves, the steam is turned off the condenser on to the under grate of the water-gas generator. The action of lowering a safety-valve compels the water gas to flow through a hydraulic seal into the gasholder. By merely regulating the valves, the water gas can be introduced into the furnace along with the carbon monoxide gas. This water-gas generator (Thwaite's patent) is also provided with an air-jacket, by which the injected air is heated by radiation from the side of the vessel. In order to enrich the water gas, there is provided a Thwaite oil-injector, by which a highly volatile liquid hydrocarbon is sprayed over the incandescent fuel during the process of producing water gas. The carbon monoxide gas generator is on Mr. Thwaite's simplex system, and is capable of gasifying about 3 cwt. of fuel per hour. It is provided with an air-jacket around the hottest part in the height of the vessel, and through which the air is aspired by means of a steam-jet air-injector. The effect of this simple addition is drier steam and air, less thermic loss by causing radiation, more equable production of gas, and cooler atmosphere around the generator. The top plates of both the generators are water-cooled; a continual flow of water being established. The heated water is available for the steam generator. It is intended to fix oil-injectors direct to each end of the furnace, to allow of firing by liquid fuel; the oil spray being delivered into the heat-accumulating chamber at each end of the furnace. The gas storeage holder, already referred to, is provided for obtaining an equable supply of water gas or other gaseous fuel produced. It is guided on the wire-rope system of Mr. Pease. This arrangement has been applied by Messrs. Ashmore, Benson, Pease, and Co., Limited, who introduced it, to Mr. Thwaite's system for the safe storeage of oil. It may be added that among the subscribers to the school are the City and Guilds of London Institute, the Drapers' Company, the Cutlers' Company, the principal local firms, and several noblemen and gentlemen—Sir F. T. Mappin, Chairman of the Sheffield Gas Company, having, besides his annual contribution, presented a donation of £2000.

BASIC UNITS OF ECONOMY IN THE MANUFACTURE OF GAS AND ELECTRIC LIGHT.

At a recent Meeting of the Society of Gas Lighting, of New York, a paper on the above subject was read by Mr. R. B. TABER, Secretary of the New Bedford (Mass.) Gas Company.

The author said his attention had been attracted to the matter of a basic unit of economy in gas manufacture, which virtually formed the subject, under another name, of a discussion at the recent meeting of the Western Gas Association at Louisville. Under the *régime* of the Gas Commission in Massachusetts, the yearly returns of each company are made up in a form prescribed by them; and the relative economy of different plants, their status before the Board, and the protection or control—perhaps their very immunity from attack may depend upon the returns thus rendered—based on the relative unit of cost per 1000 cubic feet of gas sold. To obtain this, the figures might be divided as follows: (1) Cost of manufacture, or the efficiency of the apparatus—say, coal, enrichers, water, labour, and repairs at works. (2) Cost of distribution, or the efficiency of the street mains—say, wages of meter takers, and repairs to meters and mains. (3) Cost of office, or the efficiency of the general staff. (4) Cost of capitalization, or the efficiency of the capital—say, taxes, legal

expenses, &c. The further items of depreciation and interest are carried to separate accounts. This unit, the author remarked, coincided also with the English system; and so general had the habit become, that the projectors of many of the new patent processes had taken advantage of the custom, and "cried up" 15 cent. wares, trusting that the cost of manufacture, covering only a few of the items specified above, might be confounded with the total cost delivered, as indeed it was likely to be by inexperienced investors. He thought, therefore, it would be better that similar discussions to that referred to might be held to determine a basis upon which gas engineers might agree as to the relative cost of gas making.

In the author's own case, where it was often necessary to make comparison of the efficiency of gas plants with that of electric lighting plants, and *vice versâ*, he had been compelled to adopt another system, in which the cost of gas and electricity was expressed in decimal percentages of the total income, thus affording a less circuitous route to the result wanted; in other words, expressing the unit of efficiency, not in number of feet (or, more properly, candle-feet) of gas sold, but in the income received for that quantity of gas—conditions made necessary in selling electricity, since the number of arc or incandescent lights, or even the number of watts sold, has no special significance, and was extremely difficult to obtain. In electricity, therefore, the items arranged as before are summed up relatively to the total income, and are expressed in percentages thereof. For instance, in 49 electric stations from which reports are made monthly, and cover a period of 15 months, he found that six companies gave the ratio of expense to income to be 50 to 60 per cent.; thirteen, 60 to 70 per cent.; twenty, 70 to 80 per cent.; and ten above this limit—making a total average of 69 per cent. The author pointed out that neither in the Gas Commissioners' report nor in the above enumeration of expense was any allowance made for depreciation and interest, which were carried to the profit and loss accounts, and did not figure in the relative efficiency of staff and apparatus. As a matter of fact, there was, he said, probably some error arising from this source in the following averages deduced from the last published report; yet the figures given were approximate. In the case of towns where the annual consumption is upwards of 25 million cubic feet, two report a ratio of expense to total gas and residual income of 50 per cent.; twelve, 60 to 70 per cent.; five, 70 to 75 per cent.—the average of the 73 companies in the State being slightly higher. Such figures were surely, he remarked, less scandalous and alarming than the old piratical stories of gas costing 15c., 9c., or even 3c. per 1000 cubic feet so often heard, and allowed a fair business comparison with other manufacturing industries.

With regard to depreciation and interest, these matters were, Mr. Taber said, referred to profit and loss accounts rather than to expenditure, and scarcely affected the subject of the unit of efficiency. When carried to expense, as depreciation sometimes was, it was a variable quantity, based, of course, on the amount of the repair account each year. In few cases within the knowledge of the author was a direct change made in the gas accounts; and fewer still in electrical returns, where they were seemingly more necessary. He used the word "seemingly" because the general impression was that the repair and depreciation accounts in electric stations should be very large; and he was somewhat surprised to find, in the 49 stations already referred to, that the actual cost of repairs averaged a total of 8·83 per cent., apportioned as follows: Lamps, 2·98; lines, 1·37; dynamos, 1·23; station, 1·34; engines, 0·95; boilers, 0·96. It might be presumed, then, that a station well kept up and well repaired would depreciate only by the loss of renewals as the business increased. New patents were not superseding and making valueless the earlier forms of apparatus; and it appeared to him that a proper repair account would dispel the picture of an exhausted treasury depleted by the phantom of "immense friction silently wearing away dynamos, lines, poles, &c." It was, of course, certain that in an inadequately managed electric lighting station, as in the case of gas-works similarly conducted, a wonderful amount of damage might be done in a very short time. An armature could be ruined, or broken fly-wheels send tons of iron skywards, as readily as a gasholder tank could give way or the roof of a purifier-house fall. But such things as these were not common. If the capital on which interest is based were compared with income in the more important towns of the State of Massachusetts, the ratio of gas and electric income in each city to the total invested would be found surprisingly similar. Boston, Lynn, Worcester, and Salem were good instances of this; and they served to show that the ratio of interest would not materially affect the unit of efficiency which the author had adopted for comparison for the working of gas and electric light plants.

New Gas, Water, and Electric Light Undertakings in the Southern States of America.—During the past nine months, great activity has been displayed in the establishment of new enterprises in the Southern States of America; no less than 2472 new concerns having been organized, which is only 700 less than in the great "boom" period covering the first months of 1890. Among the new ventures are 20 gas-works, 77 water-works, and 124 plants for furnishing electric light.

REGISTER OF PATENTS.

Charging and Drawing Retorts.—Ruscoe, J., of Hyde. No. 14,720; Sept. 17, 1890. [11d.]

This is an improvement on the apparatus which was described in patent No. 18,108 of 1889. It is designed primarily with the object of adapting the apparatus to work in conjunction with the moveable division-plate for charging inclined retorts described in Trewby's patent No. 19,256 of 1889, though it may also be applied to operate an ordinary charging-scoop or drawing-rake in inclined retorts. In the earlier patent, the scoop or rake moves horizontally into and out of the retorts; while in this case the division-plate or the scoop moves into and out of the retorts in an inclined plane, and the apparatus has been altered wherever necessary to the carrying out of this movement, and also with the view of supplying a specified charge or quantity of coal to each retort which shall fall in by its own gravity, without the intervention of a travelling scoop.

Fig. 1.

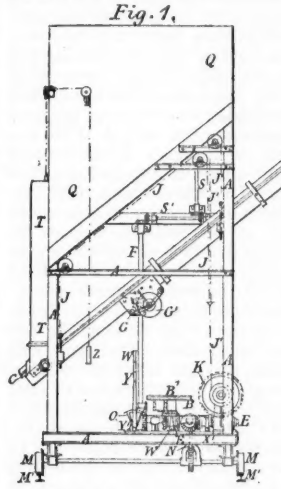


Fig. 2.

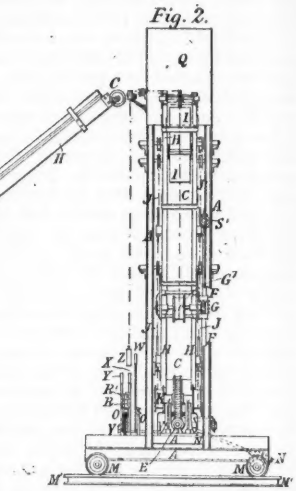


Fig. 1 is a side elevation of the apparatus. Fig. 2 is an end elevation looking towards the retorts.

The framework A is (as described in patent No. 18,108 of 1889) constructed of wrought-iron beams or girders of any convenient section, riveted or bolted together. Instead, however, of the structure being rectangular in side elevation, the upright beams at the back are longer than those at the front; and the cross or top beams affixed thereto are set at an inclination to correspond with the inclination of the retorts in conjunction with which the apparatus has to work. As the inclined top beams are not so well suited to carry the driving mechanism, it is placed upon a bed-plate between the uprights A at the base of the apparatus. The driving mechanism is actuated by an endless band or rope B; and is arranged, as before, to move the inclined division-plate C into and out of the retorts, to raise and lower it vertically, and to move the apparatus from one position to another in the retort-house. The endless rope B passes round the grooved pulley B^1, with which it is held in contact by guide-pulleys, one at either side. The rope pulley is mounted on the upper end of the vertical driving or first motion shaft; and from it motion is transmitted to the second motion shaft E by bevel wheels on the shafts. Two of these bevel wheels are placed loose on the shaft E facing each other, and are always in gear. Each of them is provided with a clutch face (preferably a friction clutch); and between them is placed a sliding double-clutch, which moves to-and-fro on a feather or key on the shaft, and is capable of being thrown into gear with either of the bevel wheels. When the clutch is out of gear with the wheels, the shaft E is at rest. When it is in gear with one wheel, it is rotated in one direction; and when in gear with the other wheel, it is rotated in the opposite direction. Thus the shaft E—which imparts motion to the other parts of the apparatus—is started, reversed, or stopped.

The motion to project the inclined division-plate into and out of the retorts is also conveyed from the second motion shaft to the vertical shaft F by bevel wheels. The vertical shaft carries a sliding worm G, which gears with a worm wheel on a shaft journalled to the underside of the frame H, which supports the inclined division-plate. On the shaft is a chain drum G^1, upon which the chain that draws back the division-plate is wound. The division-plate frame is supported, with its longitudinal members, in an inclined position, to correspond exactly with the inclination of the retorts. To the upper end of the plate is attached a carriage I, the wheels of which run in the longitudinal channel frame. The chain from the drum G^1 passes over a pulley at the end of the frame, and is attached to the upper end of the inclined plate. The plate is lowered into the retort by throwing its clutch into gear with the bevel wheel, whereby the chain is slackened, and the plate descends of its own gravity. It is raised by reversing the movement of the shafts E and F, and intermediate wheels, when the chain is wound up upon the drum G^1.

The division-plate frame is suspended in its inclined position by chains J J^1, which are wound upon the drums K K^1 affixed to the bottom bed-plate, and pass over pulleys at the top of the frame A. The two drums are placed—one at each side of the apparatus—on a cross shaft L, geared to the second motion shaft E by a worm wheel and worm. The worm engages with one side of the double clutch L^1, and receives motion therefrom. The chains are preferably arranged as shown, with the ends which attach to the front and back ends of the division-plate frame H connected together; the two ends being made of different length to give the required inclination to the frame, and one chain only being attached to each drum.

Movement is given to the wheels M, which run on the rails M¹, and which move the apparatus from place to place in the retort-house, from the second motion shaft E, by the inclined shaft N through the bevel wheels, one of which is loose on the shaft E, and is set in motion when the clutch L¹ is thrown into gear with it. On the other end of the shaft is a worm, which gears with a worm wheel on the axle.

The different movements are set in action and reversed by the hand-levers W, X, and Y. The lever W is loose on the shaft Y¹, and has pivoted to it a rod or link, which, acting through levers or cranks, gives motion to the shaft to throw the clutch E¹ into gear with either of the bevel wheels, according to the direction of motion required. The lever X is similarly pivoted, and moves the clutch L into gear to set the lifting mechanism or the travelling mechanism in motion. The lever Y is attached to the shaft Y¹, which, through a crank or lever, moves the clutch F into gear, so as to project the inclined division-plate into and out of the retorts.

To prevent the levers X and Y being inadvertently moved to throw the clutches into gear at the same time with their respective wheels, there is attached to each a spring catch R, which engages with a quadrant O, and falls into a notch therein, as soon as the other lever is moved out of its central position. Affixed to the side of each lever is a small cam or inclined bracket R¹, which extends out to engage with a bracket on the top of the catch R. The catch is pressed down by a spring. When the levers, X and Y are at their central positions, and the machine is at rest, the spring catch R in each is lifted up by the cam R¹ on the adjacent lever; but when one lever is moved from its position of rest, the cam upon it moves away from and releases the spring catch on the other, which engages with the notch on the quadrant O, and so prevents the moving of that lever until the other has been brought back to its position of rest. The cam R¹ thereon has again lifted the spring catch R of the other. By this arrangement the operator is prevented from accidentally putting two parts of the apparatus in motion at the same time. Each lever is, in addition, provided with a separate spring catch, with rounded face, which engages with indentations on the quadrant.

On the top of the framing is placed a coal tank or hopper Q, preferably of a size to carry sufficient coal to charge all the retorts in a row (say) from 7 to 8 tons. From this hopper the charge for each retort is measured off and delivered thereto, as soon as the division-plate is in position. The coal-tank Q is of any suitable construction, preferably with an inclined bottom, in which one or more holes Q¹—by preference three—are made, through which the coal passes. Below the tank Q is placed an inclined shoot or hopper, of a capacity to hold the required charge for each retort. Between the large tank Q and the hopper, sliding-doors or valves are placed, which will allow of the passage of coal at certain times and stop it when required.

Sliding-doors cover the holes Q¹, and are opened and closed by a rack and rack-wheel actuated by the shaft S, which, at its upper end, carries a worm, which gears with the worm wheel on the shaft of the rack-wheel. At its lower end it gears with the cross shaft S¹, which, at the other end, is geared with the vertical shaft F, which moves the division-plate longitudinally. When the plate is moving into the retort, the slide-doors are closed; and when it is moving out of the retort, the slides are opened. A rotating bucket wheel may be used instead, to conduct the coal into the measuring-shoot, which will continue to revolve until the compartment is full. A lid will then be raised, and the wheel stopped by the throwing out of gear of a clutch or other mechanism which drives it.

At the lower end of the measuring-hopper is placed a vertical shoot T, by which the coal is delivered from the hopper to the inclined shoot beneath the division-plate. Between the measuring-hopper and the vertical shoot is a vertical slide, with an upright rod and chain, which passes over pulleys, and has, at the other end, suspended a balance weight Z, which the attendant can use as a handle to open the slide, when he is ready to deliver the coal into the retort.

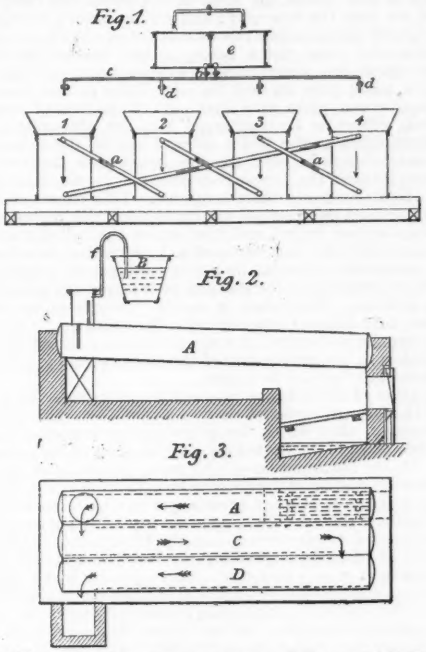
The vertical shoot T is preferably made with three sides. It is lifted and lowered with the division-plate frame H; the hoppers being stationary. The coal passes from it into the shoot through a hole cut in the division-plate. To prevent dust flying about, lips or plates are fixed, as shown; and when the frame and division-plate are lowered to the lower range of retorts, a board or plate may be mounted upon the plate to enclose the intervening space.

The division-plate may be arranged to act as a drawing-rake, by pivoting to its lower end a rake-head, which will carry before it the spent charge—discharging it at the lower end of the retort. By means of a chain attached to the rake-head at one end, and to the chain at the other, it may be raised clear of the coal before the division-plate is withdrawn.

As these machines are usually used in pairs in the retort-house—one to charge the retorts at one side, and the other the retorts at the other side—but running on the same set of rails, and driven by the same ropes, each machine has a rod or lever or other suitable mechanism, which, should the two machines come in contact, will engage with a slide tumbling lever or other reversing mechanism on the other one, and thus stop or reverse the machines, and so prevent damage from collision. The same reversing mechanism will also stop or reverse the motion of the machine at the end of its travel in the retort-house.

Revivification of Gas Purification Materials, and Treatment of the Residues.—Jones, C. W., of Milan, Italy. No. 14,906; Sept. 20, 1890. [6d.]

In the course of his specification, the patentee says: The method of revivifying the purifying material generally employed for the manufacture of gas (for example, Laming's oxide) by simple exposure and turning over in the open air, is defective in so far that, after a time, the material is exhausted, and so rendered unfit for further use as a purifying agent. The object of this invention is to render the material again active, and to obtain at the same time, as a residue, the composition of ferric-cyanide, which renders the material inert as a purifying agent. Accordingly the exhausted material is watered, and mixed with (say) about 6 per cent. of quicklime. It is then placed in a heap, and allowed to remain until the reaction is complete, which is noticeable by its change of colour, owing principally to the oxidation of the sulphates of iron and the expulsion of a certain quantity of sulphur. The lime has now transformed the sulphates and compounds of ferric-cyanide into the corresponding salts of lime; and the oxide is reformed, and ready to be washed in order to take out the cyanides in combination with the lime.



The washing and subsequent treatment of the washing liquor may be effected in apparatus shown in the accompanying illustrations. Fig. 1 is an elevation of the washing apparatus. Fig. 2 is an elevation. Fig. 3 is a plan of an arrangement of boilers for evaporating the washing liquor.

The material is placed in a series of vessels or receptacles (numbered 1, 2, 3, and 4 in fig. 1), connected together by circulating-pipes *a*, and clean water (soft water being preferred) is supplied by an arrangement of pipes *b*, *c*, *d*, from a tank *e*. The circulation is so arranged that one of the receptacles remains full; and after being subjected to the washing, it is emptied of the material, recharged, and retakes its place in the circuit. The material when washed is ready to be used in the purifiers. The whole of the receptacles are in communication with a reservoir (not shown), which receives the washings when the necessary strength and richness in cyanides is attained. The washing liquor is put into a series of boilers (shown in figs. 2 and 3), the first boiler A of which is closed by a syphon *f* dipping into a vessel B containing sulphuric acid, which collects the ammonia during evaporation. The succeeding boilers C and D are simple evaporating-pans exposed to the air, and from which the cyanides are obtained in the form of a paste.

Gas-Engines.—Higginson, J., of Manchester. No. 17,371; Oct. 30, 1890. [8d.]

In gas motor engines as at present constructed, says the patentee, there is considerable loss of heat through the sides of the cylinder, from the gases of the explosion to the water-jacket, with which it is usual to surround such cylinders. There is also a great loss of heat in the hot products of combustion leaving the engine by the exhaust-pipe. One object of this invention is to diminish these losses, and to so arrange an engine that at least a part of the heat so lost is saved, and made available for the production of motive power.

The invention may be carried into effect in several ways bearing this object in view. To a gas-engine of the "Otto" or "Beau de Rochas" cycle, it is applied in the following manner, which considerably modifies the action of the "Otto" cycle as commonly understood: In a cylinder, there works a piston connected by a rod to a crosshead, in connection with the main crank. The piston-rod passes through a cylinder cover and packing gland; and the front end of the cylinder is used as an air-compressing pump—the piston taking in air from the atmosphere, and compressing it into a reservoir. This reservoir surrounds the combustion chamber of the engine; and the combustion chamber exterior surface within the air reservoir has cast upon it radiating ribs—which may be formed as a screw or spiral—along the channel of which the compressed air from the pump passes, and becomes highly heated. The back end of the cylinder is used as the combustion or power end; and that end of the piston is connected to a loose piston by a piston-rod and cushion cylinder, or other suitable connection.

Compressed air is admitted between the main piston and the loose piston valves, for a purpose to be hereafter described. When the main piston makes its exhaust stroke, the compressed air between it and the loose piston causes the latter to enter the combustion chamber, and clear out practically all the products of combustion. The exhaust gases preferably pass through a regenerator constructed of perforated plates. A valve cuts off communication between the combustion space and the regenerator when required; another valve cuts off communication between the atmosphere and the regenerator as required; while a third valve opens to the compressed-air reservoir when necessary.

The general action of the engine is as follows: On its first out-stroke, the cylinder is filled with air behind the piston; and some air is compressed into the reservoir. On the return stroke, or while the crank is crossing its out-centre, gas is injected into the air behind the piston by means of a pump; and this gas mixes with the air

already contained in the cylinder to form an explosive mixture. This is compressed on the return stroke into the combustion space; the loose piston yielding to the compression, and leaving the required space. It is then fired, in any known manner, and the explosion pressure forces forward the motor piston on a working stroke. At the termination of that stroke, the front of the piston has compressed a portion of air into the reservoir; and on the return or exhausting stroke, the motor piston expels the exhaust gases almost entirely from the cylinder—the loose piston being pressed forward by the compressed air which has forced its way between it and the main piston. The exhaust gases pass through the regenerator to the atmosphere; and the regenerator picks up a large part of the heat of those gases which would otherwise be discharged into the atmosphere. At or near the termination of the piston exhaust stroke, the exhaust-valve closes communication between the regenerator and the atmosphere; but the valve between the combustion space and the regenerator is kept open, and the air-reservoir valve is opened. This causes compressed and heated air from the reservoir to pass through the regenerator. It thus becomes further heated, and then enters the cylinder and drives the piston forward; the heat imparted to it increasing its volume considerably, so that its volume at the higher temperature is much greater than at the temperature of compression as it leaves the pump or front end of the cylinder. This gives a second power impulse; and it is one characteristic feature of the invention that, with the "Otto" cycle engine, an impulse is obtained at every revolution; one impulse being given by explosion, the next by heated air, and so power is gained from heat which would otherwise be wasted.

The hot air is admitted to the regenerator and cylinder for a certain portion of the forward stroke of the piston, and then cut off at the reservoir air-valve, after which the piston continues to move on, under the expansive effect of the heated air, until the end of the out-stroke is attained. On the return stroke of the motor piston, after the hot-air working stroke, a portion of the air may be exhausted or not as desired; but in any case gas is injected from a pump, and mixes with the air contained in the cylinder. This forms an explosive mixture, which is compressed into a combustion space; the loose piston yielding to the compression, and forming a space between it and the end of the cylinder in which combustion may take place. On explosion by an igniter, the first effect is to compress the loose piston still further, and so relieve the pressure of the explosion; the power, however, being given out as the piston proceeds on its stroke, and so a more uniform pressure is kept up. The piston then compresses air in front; and the whole cycle is repeated.

APPLICATIONS FOR LETTERS PATENT.

16,161.—Williams, F. P., "An apparatus or appliance for joining together lead or india-rubber piping commonly used for the conduct of either gas or water." Sept. 24.

16,176.—Leoni, S., "Improvements in gas-fires." Sept. 24.

16,326.—Fleischer and Co., "Improvements in gas-pressure regulators." Sept. 25.

16,404.—Clerk, D., "Improvements in gas-engines." Sept. 28.

16,459.—Beechey, C. G., "Improvements in or connected with gas-meters." Sept. 28.

16,543.—Ely, J., "Improvements in machinery or apparatus for charging gas-retorts gradually; such charging being either continuous or intermittent." Sept. 28.

16,578.—Nugent, H. W. P., "Improvements in retort-charging apparatus." Sept. 30.

16,583.—Grimshaw, W. D., "Improvements in or applicable to mechanical stokers." Sept. 30.

16,639.—Clark, W., "Improvements in water-meters." A communication from Schmidt and Co. Sept. 30.

16,657.—Moscrop, W., "Improvements in gas outlet-valves or plugs for electric battery cells or other like vessels." Oct. 1.

16,696.—Spiro, E., "Improvements in fluid-meters." Oct. 1.

16,742.—Husband, W. T., and Gibbings, W., "A regulating tap for liquids or gases." Oct. 2.

16,795.—Koch, F., "Automatic apparatus for turning off gas." Oct. 3.

16,796.—Koch, F., and Loher, F., "Automatic device for turning off the supply of gas." Oct. 3.

16,807.—Bird, S. V., and Wood, J. S., "Improvements in open gas fires or stoves." Oct. 3.

16,833.—Claremont, E. A., "Improvements in or relating to gas-engines." Oct. 3.

16,904.—Suiter, A., and Margary, A. R., "Improvements in regulators for compressed gas." Oct. 5.

16,937.—Prestwich, W. H. and J. A., "An improved rotary motor actuated by steam, gas, and other like high-pressure expansions." Oct. 6.

16,992.—Wright, W. S., "Improvements in gas-lamps." Oct. 6.

17,033.—Shiels, A., "Improvements in apparatus for automatically regulating the temperature of the water used in cooling the cylinders of gas and oil engines." Oct. 7.

17,099.—Riley, S., "An improved safety hand lamp for gas lighting." Oct. 8.

17,193.—Parker, F., "Improvements in gas heating appliances." Oct. 9.

17,202.—Faija, H., "Improvements in apparatus for controlling the supply of water or other liquid." Oct. 9.

17,212.—Clark, S., and Hatcher, F., "Improvements in gas-stoves." Oct. 9.

17,222.—Creswick, W., "Improved arrangement of coke ovens and retorts for the manufacture of coke and illuminating gas." Oct. 9.

17,233.—Donnithorne, E. G. M., "Improvements in gas-engines." Oct. 9.

17,245.—Grant, C., "Apparatus for locking one or more taps or cocks, applicable more particularly to gas-stoves." Oct. 10.

17,265.—Barker, T., "Improvements applicable to gas lights and other lights." Oct. 10.

Reduction in the Price of Gas at Wimslow.—The Directors of the Wimslow Gas Company have reduced the price of gas from 5s. to 4s. 6d. per 1000 cubic feet.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Board Scrubbers.

Sir,—Your report of the meeting of the North of England Gas Managers' Association at South Shields was not seen by me till after reading Mr. George Livesey's letter on "Board Scrubbers;" but it was a satisfaction to me to find that he had at once taken steps to put the matter right, as I had no idea of disturbing what had been settled long years before. I now express regret that I was to blame in the matter of which he complains, as I conveyed to your representative, I believe, the idea that my scrubber was in use before Mr. Livesey's; whereas I should have said that it was in use before Mr. Livesey's invention was *published*. The fact is I had but a few minutes with your representative in the Board-room just before the business commenced; and in reply to his inquiries about the gas-works, I mentioned this scrubber, my centre-valve, and other matters which I thought might be interesting to the members of the Association. I had no idea, however, of setting up a rival claim to the priority of this invention. There was a mutual understanding, I have always believed, that this matter was disposed of at the time of the discussion upon the paper, when, as Mr. Livesey states, I "claimed to divide the honours" with him; and this claim, as far as I know, has never yet been disputed, nor do I think it can be.

It was in June, 1870, that Mr. Livesey read his most interesting and valuable paper "On Scrubbers," on which occasion, as far as I know, there was the first publication of this invention. Now, I have a letter by me of the previous October, 1869, which contains a passage from a letter written by Mr. Barlow to the representative of a Company to which Mr. Barlow was Consulting Engineer. It is as follows: "A gentleman of the name of Warner, of the South Shields Gas-Works, was showing me the other day a very powerful and effective scrubbing apparatus, which would go in about 4 feet or 4 ft. 6 in. square, and might be fixed between the retort-house and the coal-store." The model of this scrubber was experimented with at Mr. Barlow's offices, and was left there till fetched away for the discussion of Mr. Livesey's paper.

Previous to the erection of the scrubber at South Shields, I had made experiments with "*thin boards*," and determined upon placing them at an angle instead of putting them in vertically, because I felt assured the work I required would be better done—passing the gas through such a vessel *before* the condensers, with a very small flow of liquor over the trays of boards. The reason for putting the boards (not "pieces") together in the form of trays was that they might be more easily handled if they had to be removed for cleaning from time to time. Further, the tray form allowed of getting between the tiers, and also of separating them for the better breaking up of the descending liquor.

As to the action of the water through these trays, where it was spoken of as being "quite a shower as of rain," it was meant that the distribution was so perfect that, upon looking between the trays, the appearance of the down-flowing liquor was that of "a shower of rain," not divided streams. The object aimed at was the effective distribution of the smallest possible quantity of liquor without any machinery whatever; and this was attained. "A copious shower" was never intended, nor ever given.

The apparatus and its relative position in the plant were subsequently patented by an American for the same purpose as that for which I used it—reducing the amount of naphthalene carried forward to the distributory plant—as was noticed by myself in the Journal some years ago; and in this work it does most excellent service. As a proof, some time since I had, in making alterations, to divert the flow of the gas. After these were made, there was not time to change the flow back again that season; and the consequence was an increased number of complaints. I may here add that some time ago I was written to upon the question of naphthalene by the engineer of a large works, who was at that time much troubled with this pest. In my reply, I referred to the condition of the South Shields complaint-book: "Last week (October) we had, from all causes, 18 complaints, 10 of which were services. Of public lamps, there were 21 defective. The number of consumers is 7039; public lamps, 2685. Standard, 16 candles."

I fear I am trespassing upon your space; but allow me to say, with reference to the reward for the invention, that if Mr. Livesey has received nothing but the credit, I have not received even this much, and

"These little things are great to little men."

South Shields, Oct. 17, 1891. W. J. Warner.

Electric Lighting of Bray.—The whole of the town of Bray, known as "the Brighton of Ireland," is to be lighted by electricity. Messrs. J. E. H. Gordon and Co., Limited, have secured the contract, and have put the work in hand. The principal streets are to be lighted with arc lamps, and the rest on the incandescent system. The electricity will be generated by water power in the town. It may be remembered that the above-named firm have the contract for the lighting of Larne, with regard to which we may say that a personal inspection of the installation about a month ago did not impress us with either its beauty or its efficiency. It is to be hoped that, in their new sphere of operations, they will have a better field for the exercise of their skill.

The Price of Gas at Bradford.—On the motion for the adoption of the minutes of the Gas and Electricity Supply Committee, at the meeting of the Bradford Town Council last Tuesday, Mr. Hindley asked whether the price of gas could not be reduced. Leeds gas, he believed, was 6d. per 1000 cubic feet less than that of Bradford; and they were paying £1200 to the Government in income-tax on the gas profits. Alderman F. Priestman (the Chairman of the Gas Committee) replied that he thought the next movement in the price would be upwards and not downwards. He was not able to say authoritatively what Leeds was charging for gas. But some time ago the price was 1s. 10d., and then it was raised; and he believed now, taking into account the discounts allowed in Bradford, the price there was less than it was at Leeds.

LEGAL INTELLIGENCE.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Thursday, Oct. 15.

(*Before Sir* P. H. EDLIN, Q.C., *Chairman, and a Bench of Magistrates.*)

The Gaslight and Coke Company's Assessment Appeals.

(*Continued from p.* 405.)

The hearing of these appeals (adjourned from the 7th of August) was resumed to-day; the proceedings opening with additional evidence on behalf of the Company.

Mr. LITTLER, Q.C., Mr. CASTLE, Q.C., and Mr. DANCKWERTS appeared for the appellants; the SOLICITOR-GENERAL (Sir E. Clarke, Q.C., M.P.), Mr. POLAND, Q.C., and Mr. R. C. GLEN represented the City of London Union; and among the Counsel engaged on behalf of the other respondents, of which there are a large number, were Mr. FULLERTON, Q.C., Mr. HOUGHTON, Mr. LYONS, Mr. ROBINS, Mr. W. RYDE, Mr. J. V. AUSTIN, Mr. BEVAN, Mr. A. H. BODKIN, Mr. HORACE AVORY, Mr. MARSHALL, Mr. BUCKMASTER, Mr. A. GLEN, Mr. GERMAINE, and Mr. J. MONTEFIORE. To advise on professional matters, Mr. CORBET WOODALL and Mr. H. E. JONES were retained for the appellants; Mr. W. A. VALON for the City of London, the City of Westminster, and the parishes of Hackney, Kensington, Shoreditch, Bethnal Green, St. Giles's, and St. George's, Bloomsbury; and Mr. W. R. CHESTER for the Islington Vestry.

Mr. *Corbet Woodall*, C.E., examined by Mr. LITTLER, said he had formed an independent valuation of the Company's works for the purposes of the appeal. He had also been in Court and listened attentively to the evidence given by Mr. Jones and Mr. Field. His own separate valuation worked out to rather less than that of Mr. Jones; but, generally, he concurred with that gentleman. His valuation, made upon the figures for the year ending June 30, 1890, was £371,554; but this figure was arrived at without modifications either for the rise in the price of gas or for the alteration in the price of coal. He quite agreed with Mr. Jones that such a valuation would not be fair to the parishes; and, modifying the figures by the increase in price to the consumers, and also the additional expense which the Company had to incur, he brought the valuation out at £438,554. Mr. Jones had made a certain allowance or calculation based on the probability of an enhanced price being obtained for coal and coke. Experience acquired since the adjournment, however, had not borne out the anticipation that the latter would increase; in fact, the tendency had been almost constantly downwards, and was so still—he should certainly say to the extent of 20 per cent.

Cross-examined by the SOLICITOR-GENERAL: It was about twelve months ago when he was invited to make an examination of the concern. He did not go before the Assessment Committees; and, in fact, he knew nothing whatever of the circumstances relating to those Committees. He did not think he had ever had any valuation made by other gentlemen put before him. He knew that such valuers as Mr. Castle had been engaged; but he was not aware of the results of their valuations. He was not connected with the appellants, nor had he been associated with any undertaking which now belonged to the Company; but he was for many years Chief Engineer of the Phœnix Gas Company, which was now a portion of the South Metropolitan Company. Coals, which averaged 13s. 2·8d. per ton in the year to June, were costing at the end of that period 16s. 4d. per ton. The date up to which his valuation was made was June 30, 1890. He did not know what the cost of gas was now. He was aware that the price of coal had been substantially reduced; and this confirmed his estimate, because he had taken 14s. 8d. per ton, whereas the price in June, 1890, was 16s. 4d. Asked if he suggested that the prices ruling during the last completed half year had equalled 14s. 8d. per ton, he said certainly, he should be very much surprised if they had not; but he had not investigated the matter.

The CHAIRMAN: Those figures would therefore appear to have been arrived at upon a consideration of the reduction in the price of coal?

Witness: Certainly. Will you forgive me going back for a moment? I find that the price of coal for the half year to June, 1890, was 14s. 7d. per ton; in December, 1890, it was 15s. 10d. per ton; and for the half year ending June, 1891, it was 16s. 4d. per ton. So that, up to the last published accounts, there has been a steady advance. I have valued the manufacturing and storeage plant and buildings at £4,899,500; but I have not gone into that valuation with anything like the detail of the last witness [Mr. Jones]. I took that average simply by multiplying the quantity of gas made at the various stations by a round sum of £250 per million; and this comes to within the veriest trifle of the valuation made by Mr. Jones, in elaborate detail. I have obtained that figure from my own experience of the cost of such works.

The SOLICITOR-GENERAL: Do you say that that is the cost of the production of gas at other works?

Witness: I say for that amount works of the character of those of The Gaslight and Coke Company could be built. I speak with a good deal of experience in the construction of gas-works; and I can only ask you to take it as the result thereof that, in my opinion, £250 per million is a sufficient, and not too large a sum for the building of these works. I have not gone in detail into any question of the value of land, the cost of buildings, and so on. The value of the land I believe I obtained from Mr. Castle; but that is the only figure I accepted from him.

You have put down "Repairs and maintenance—estimated proportion for work other than that upon rateable property, equal to 4d. per 1000 feet sold." How have you made your distinction between the repairs and maintenance upon rateable property and that which would be the tenants?—I admit it is a very rough distinction indeed. I have taken two-thirds of the whole expenditure as being the proportion that, in my opinion, is fairly due to the tenant. The entire expenditure shown by the accounts to have been incurred in the year for the whole of the repairs was £328,947.

Two-thirds of £328,000 will give us £218,000?—I make it £301,000. I have taken it for the year 1889, and that is probably where the difference between us comes in. The value of 1d. per 1000 cubic feet in the year 1889 is £75,438; and I have multiplied that by four, and the result comes to £301,000. The half year to June, 1890, was rather less than that to June, 1889.

Cross-examination continued: I obtained my figure of 4d. per 1000 cubic feet sold by taking two-thirds of 6d., which I consider a fair expenditure. The actual expenditure was not 6d. but 4d. and a fraction; but instead of taking the actual figure expended, I have taken a hypothetical figure of 6d. If I had taken the actual expenditure, the two-thirds would have been £218,000. In reference to the wear and tear in the seven years from 1876 to 1882, the actual average expenditure in repairs and renewals was 6·65d.; in the following seven years, it came down to 5d.; while last year it was 4·70d.

The SOLICITOR-GENERAL: According to one of the tables handed in by Mr. Jones, the figures for the last five years are 5·55d., 5·68d., 3·83d., 3·83d., and 4·10d. This does not give you an average of over 6d.?

Witness: No, it does not; but I say—and I do so as emphatically as I can—that I am sure those figures do not represent the sum which should have been spent by the Company in upholding their works.

Do you agree with Mr. Jones that everything has been kept up?—I have no doubt whatever that everything has been kept up for the proper manufacture of gas; but I am quite sure that certain matters of reparation and renewal have been delayed because these have been "lean" years with the Company. They have been delayed; but they will have to be dealt with later on. In my experience with the Phœnix Company, that item never came under 6¼d., and was sometimes as high as 9d. per 1000 cubic feet. The average of the South Metropolitan and Commercial Companies from 1883 might possibly be less than 4d.

If that is the case, all the Gas Companies must have been neglecting their establishments?—During the last few years they have unquestionably been exercising the greatest possible economy in this direction; and the result of that is to bring down the expenditure.

Over how many years do you put it that this condition of things has extended?—Five or six. It must also be borne in mind that there are a considerable number of new works brought in, which have tended also to keep down the item of repairs.

In the sundries you put in the whole of the law charges, including parliamentary charges. Does it not appear to you that the parliamentary charges are the landlord's?—That did not occur to me; it is so difficult to separate the incidence of these items.

Mr. LITTLER: I think your Worship will agree with me that it would be a tenant's charge, under the circumstances. It was an expenditure in opposition to powers proposed to be taken with regard to steam-rollers; and that would be a tenant's charge.

The SOLICITOR-GENERAL said he would take the opinion of the Court upon that.

In further cross-examination by the SOLICITOR-GENERAL, witness said that he had taken the tenant's capital at £1,900,000, the proportion of working expenses at five-twelfths, and the stock of coal at 450,000 tons. The latter was not an independent suggestion of his; the officers of the Company, Mr. Jones, and himself agreed that a smaller quantity than this would be unwise. He believed the Company had more coal in store at one time—probably just before Christmas, 1890. This was exceptional up to that time; but it certainly would not be so in future. He could speak from his own experience, as a Director of two or three gas companies, as to the absolute necessity for an increase of stocks of coal now. Coal-owners had made much more stringent conditions than hitherto as to the manner in which coal should be delivered; and they required that, instead of gas companies taking the coal as it was used—that was to say, a very much larger quantity in winter than in summer—they should have it in even quantities throughout the year. This meant keeping a very much larger stock at the commencement of the winter.

The SOLICITOR-GENERAL: But it means getting it cheaper. If you accommodate the coal merchants by taking it month by month, do you not get it cheaper?

Witness: Put it the other way. If we did not accommodate them, we should have to pay very much dearer. It is rather a question of dearness than cheapness. If the coal-owners had to store the coal for us, they would charge us for that. I am speaking from general experience, and with a knowledge of recent contracts.

Have you in your mind now an actual contract, with an alternative price?—No. I do not think the alternative has been offered lately. It has been a condition that we shall take the coals as nearly as may be in even deliveries throughout the year. The quantity of coal consumed by the Company in 1889 was 1,875,000 tons; in the year 1890, it was 1,954,000 tons. I have taken five-twelfths of the working expenses, including the price of coal so far as it comes into those expenses, at £1,255,000. I have given £510,000 for coal in five-twelfths of the expenditure. That sum would represent 800,000 tons.

So that you are proposing to allow the tenant the value of nearly two-thirds of the quantity of coal that he has in the year. The tenant would get in his coal month by month, and would pay for it month by month, or he might be called upon to do so. The coal costs him a little over £100,000 per month. You give him, as a proportion of working expenses attributable to coal, over half a million of money, and also the £326,000 for stock. You are therefore actually allowing him £880,000 for coal; and you suggest that he would require this amount of capital for his raw material, although he would only have to pay out £100,000 a month?—He would have to pay £1,250,000; and I allow him £850,000. I beg you to understand that I regard this 450,000 tons as something altogether outside the 2,000,000 tons with which he is working. He uses this quantity in the course of the year; but he should have in his store regularly 450,000 tons. When I say "regularly," I mean that he should have it in the winter time.

You do not suggest that he ought to have 450,000 tons of coal put away somewhere, besides the regular supply from month to month which will meet the whole of his annual needs?—I do, distinctly.

The CHAIRMAN: Absolutely dead tenant's capital?

Witness: Dead tenant's capital lying ready for contingencies.

The SOLICITOR-GENERAL: Put the 450,000 tons out of view. The tenant has 100,000 tons of coal coming forward every month for the convenience of the coal merchant, and supplied to him at a time when he does not need to use 100,000 tons in a month, but which he is

steadily accumulating against the time when he will require it. When he reaches the end of the year, he would, according to your hypothesis and suggestion, not only have the accumulated coal which has come in at the rate of 100,000 tons a month, and has given him a stock, as we know by experience, of from 300,000 to 400,000 tons in November, but also 450,000 tons lying idle for his use if he wanted it. Is that what you suggest as the reasonable conduct of a gas company?

Witness: I do not quite see how that would work without putting it down; but what I do repeat is that, in the winter time, the tenant would use the whole of the coal represented by five-twelfths of the expenses, and, in addition, he should have this large stock in hand. The Company are conducting their operations on this principle.

They are conducting their operations upon the principle of getting in one instance, and only in one, 450,000 tons from the accumulation of deliveries during the summer; not upon the principle of another 450,000 tons lying idle?—At the time the 450,000 tons have accumulated, they are at the commencement of winter. It is quite true that, following this regular delivery, they would receive rather less in the winter months than the quantity they would use; and, consequently, they would fall upon this store. So far as the difference between the quantity they should receive (if they are receiving as much as they use) and the regular delivery is concerned, I think there is something in the case you are putting; but how much there is in that case, I do not see at the moment.

Cross-examination continued: With regard to the meters, I had a statement sent to me, and I put my valuation upon it. There is a difference of £36,000 between my figures and Mr. Jones's, owing to the fact that I have allowed less for depreciation than Mr. Field did. I maintain that the Company's meters are practically as good as new throughout; and that a depreciation of 10 per cent. is ample. For less than 10 per cent., contractors will uphold and renew a stock of gas-meters—maintaining them always in perfect working order. I do not know why Mr. Jones gave 25 per cent. I have never heard of a larger allowance than that; I have never myself allowed 33⅓ per cent. The Company have written off the value of these meters a very large sum—quite unnecessarily, I think. I have taken from Mr. Jones the figures for tools, furniture, chattels, and sundry stores, including unsold residuals. One of Mr. Jones's tables gives an item of £161,795, which includes retorts. That would be for retorts unset—retorts on the ground.

The SOLICITOR-GENERAL: I suggest that retorts are part of the rateable hereditament, and that it is not the business of the tenant to renew that?

Witness: It certainly is the business of the tenant to do it; it is the heaviest part of his repairs.

He will have to do it as a matter of convenience; but the cost ought to fall upon the landlord?—Although it is the tenant's work that is going on continually from day to day?

I suggest so; and it is for the Court to decide?—I should say it was tenant's repairs. But if that view is correct, I should have to take something from the 4d. per 1000 cubic feet which I have allowed for tenant's repairs, and add it on for the landlord's, because a part of that includes the setting of retorts. I believe tools, implements, and furniture include the whole stock of tools, whether they are used for landlord's or tenant's repairs.

If the landlord's repairs are to be taken as one-third of the whole expenditure, would it not be fair to take one-third of the tools as well? No, I do not think so; but I cannot give the figure, because I hardly know what the tools required for landlord's repairs would be.

Cross-examined by Mr. FULLERTON: The consumption of coal in the winter has been so great, that at one time the whole stock of the Company was represented by two or three days' supply. But, of course, they have never been really without coal. Having a stock like that—450,000 tons at the commencement of the winter—they have drawn upon the whole of it, and practically exhausted it before the winter was out, and then been in great anxiety from day to day.

In cross-examination by Mr. MARSHALL, witness said he had taken £67,615 for repairs to meters and stoves. This figure was given in the Company's accounts as the actual expenditure. He did not remember that Mr. Field had stated that more than £8000 was for depreciation in respect of stoves. It did not seem to be correct to include that large sum for depreciation in an item described as actual expense for repairs; but if it had been put aside to provide for renewals, then he thought it quite right that it should be included. He regarded the distinction between directly-productive and indirectly-productive mains as so extremely difficult in this case, that he very much wished it were wiped out altogether; and he thought this might be done with profit to everybody. He would have the whole of the mains treated as indirectly productive, whether they were used for service to a consumer or for connecting up stations. He would put them as part of the works of the undertaking, and divide only the balance among the parishes, in proportion to their revenue. He had taken the 48-inch and 36-inch mains as being clearly too large to be service and distributing mains; and he had called them indirectly productive. It seemed to him to be perfectly just and right that parishes which had these mains running through them should be paid for them. Whether it was a distributing main or an arterial main, it occupied the ground of the parish in just the same way, and burdened the parish to the same extent.

In re-examination by Mr. LITTLER, witness said that, owing to strikes and other things, the conditions of gas undertakings had altered materially within the last few years; and therefore the amount he had put down for coal was not anything more than a prudent tenant ought to have for it, especially in a business where failure meant leaving a great Metropolis without gas. A retort would last about two-and-a-half or three years. It was completely burnt away by the active operation of the tenant's work; and there was no comparison between the retort itself and the walls or roof of the retort-house, nor even with the arches in which the retorts were set. In point of fact, it was a consumable material, and was consumed. Looking to the obligations of the Company's Acts, it would not be possible to rely upon a continuance of the low figure which had been paid for repairs during the last two or three years. The Company could not go on at that low rate. Three things accounted for this low figure in the past. In the first place, the years being lean, gas companies had postponed all repairs, except those absolutely necessary; secondly, in some instances the works had been new; thirdly, labour and material were lower.

Mr. LITTLER then stated that, as this was really a matter for engineers, and as he did not think it was worth while to duplicate their evidence, he did not propose to call any further witnesses.

Mr. *Harry E. Jones* was then recalled, by permission of the Court, in order to furnish details of the £34,522, the estimated value of tools, &c., at Beckton. In reply to Mr. MARSHALL, he said that there were 23 locomotive engines—16 being valued at £900 each; two at £850 each; one at £900; and four at £425. There were also 150 coal-waggons, valued at £4850; and 320 coke-trucks, valued at £8300. There were 178 end-tipping, and 146 side-tipping rubbish trucks. He would hand in a table giving the exact details. With regard to the repairs of stoves, he could not give any details as to the £29,000 arrived at from Mr. Field's estimate; but he did not consider it excessive. He was carrying on the same kind of work in other gas companies. The stoves were fragile and very perishable. The "repairs" included such work as this: People changed their fashion, and returned their stoves after having them out for a year or a year and a half. The stoves had then become second-hand; and there was all the expense of taking down and bringing back into store, and polishing up, before they could be sent out again, although the stoves were probably not very much worse than when originally supplied. There was no doubt gas-stoves were very popular; but the trouble and expenditure in connection with them was much more than the Companies had been prepared for.

The Solicitor-General then opened the case for the respondents, and called evidence in its support. This was continued on the following day; at the close of which the inquiry was adjourned till the 5th of November. The report of this portion of the proceedings will appear in subsequent issues.

Alarming Gas Explosion at Nottingham.—A serious gas explosion took place last Saturday week at the Queen's Walk Police Station, through the thoughtlessness of two police constables. Becoming aware that there was an escape of gas in the office, the men began to test the fittings with matches. One of them mounted a high desk for the purpose of trying a gas-pendant; but the instant he applied a lighted match to the pipe, a tremendous explosion occurred. The shock of the explosion was experienced for a considerable distance; and this, coupled with the loud report, caused a large crowd of people to at once assemble outside the building, the interior of which was in flames. On an entrance being effected, it was found that the place had been almost wrecked, and that the two officers were very badly burned. After their injuries had been dressed, they were conveyed home in cabs. On examining the pendant, it was found that there was a long crack at the top, extending down for more than a foot.

The Quality of the Gas at Chesterfield.—At the monthly meeting of the Chesterfield Town Council last Tuesday, Mr. Locke introduced the subject of the quality of the gas supplied by the Chesterfield Gas Company. The gas, he complained, was very poor in illuminating power; indeed, he found it difficult to read by it. The Watch Committee had an apparatus for testing the gas; and, according to the minutes of that Committee, the illuminating power of the gas for the past month was as follows: Average, 14·56 candles; maximum, 17 candles; and minimum, 14 candles. The minutes also contained the information that, on fifteen occasions, the pressure was too low for tests to be made. It was high time the Corporation took some action in this matter. They had sat under a monopoly long enough; and if they could not do anything with the Gas Company, could they not grant powers to an electric lighting or some other Company to light the town. Alderman Wood said this subject had been discussed frequently by the Watch Committee; but they had really very little power in the matter. They could, if they pleased, get an expert to test the gas at the works; but they would have to give the Company twenty-four hours' notice of his visit. The test the Corporation had was looked upon by the Gas Company as untrustworthy; and under the tests they made, they would be unable to take any proceedings against them. The Mayor (Mr. J. M. Clayton) said it would not be much use to have an expert to test the gas at the works if twenty-four hours' notice of his visit had to be given to the Company. The matter was dropped.

Complaints as to the Quality of the Bradford Corporation Water Supply.—During the last few weeks, the residents in the Manningham and Heaton districts have been making grievous complaints as to the quality of the water supplied to them by the Bradford Corporation; and the matter was referred to by Alderman Holdsworth, in moving the adoption of the minutes of the Water Committee, at the meeting of the Council last Tuesday. He said that, for the past twelve months or more, the general opinion had been that the impurity of the water supplied in the districts named arose from the state of the Chellow Dean reservoirs. The complaints had, however, been so strong lately that the Water Committee had come to the conclusion that there must be some other reason. Investigations had, therefore, been made; and the cause of the impurity had been found. For thirty or forty years past, there had been about three miles of "sanitary-tube" main, extending from Many Wells Springs to Chellow Heights. The pipes were oval ones, 15in. by 12in. In course of time, it was found that vegetable growths had begun to appear in the main, especially at the joints of the pipes. In the earlier part of the summer, the weeds exuded a milky juice, which accounted for the bad smell of the water. About the end of September, portions of the vegetable matter began to decompose; and in this way the deleterious effects of which complaint was made had been caused. For the last twenty years, the nuisance had been gradually getting worse. The idea that the water was being contaminated in Chellow reservoir was widespread; but this was not the case. The water was carried straight from the terra-cotta pipes he had mentioned into iron pipes which supplied the Manningham and Heaton districts. The Committee had taken care that the nuisance should not occur again. During the past few days, the districts in question had been supplied from the high-level reservoirs; and it was proposed to empty the higher reservoir at Chellow Dean. The motion was seconded by Alderman Moulson; and, after discussion, the minutes were approved, except one relating to the supply of certain houses at Bolton Woods.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The London County Council and the Standard of Light.

At the Meeting of the London County Council last Tuesday, the report presented by the Sanitary and Special Purposes Committee contained the following observations on the subject of the standard of light employed in the testing of gas in the Metropolis :—

We have from time to time reported as to the defects which exist in the Acts controlling the gas supply of London, the most important of which is the provision of a most unsatisfactory standard of light. For many years past the importance of substituting a more exact and trustworthy standard has been urged upon the Board of Trade, with no satisfactory result, notwithstanding the fact that the present standard adds greatly to the difficulty of ensuring good gas, and is probably the cause of much loss to the consumer. We were consequently glad to be able to report, on the 28th of July last [*ante*, p. 217], that the Board of Trade had undertaken to appoint a Scientific Committee to consider what the standard of light should be. In intimating this intention, the Board of Trade asked if the Council would be prepared to bear the expense of such a Committee. To that we replied that the Council had no power to make any payment for such purpose ; and we urged that the question of ascertaining what is the best standard of light is one of Imperial importance, which might properly be dealt with by the Board of Trade. We have since received letters to the effect that the Board of Trade has no fund out of which to defray the cost of such an inquiry ; and that as neither the Council nor the Gas Companies are in a position to find the necessary funds, it does not appear practicable to nominate the Committee. We much regret the decision of the Board of Trade, and trust it may be possible to obtain a reconsideration of the question. We are convinced that the uncertainty and loss caused by the defects of the present standard should be at once put an end to. Ten years ago a Committee appointed by the Board of Trade reported adversely to the present standard, and suggested a trustworthy one ; but until that Board takes up the question in earnest, we fear little can be done. The Council has already decided to introduce a Bill next session for altering the standard of light ; but it may be useless to take this course unless an authoritative Committee has previously decided what the new standard should be. In these circumstances, we have urged the Board of Trade to reconsider the question of nominating a Committee for the purpose.

The proceedings of the Committee in this matter were confirmed.

DANISH GAS COMPANY.

Report by the Engineer on the Progress of the Undertaking.

The Engineer of the Danish Gas Company (Mr. F. D. Marshall) has just presented to his Directors the following interesting report on the working of the undertaking in the year ending June 30 last, and also on its progress in the ten years during which it has been under his supervision :—

The total extra consumption of gas for the year was 35,335,000 cubic feet, or an increase of 16·4 per cent. as compared with the previous year. The quantity of lighting gas sold in 1890 was 166,603,000 cubic feet ; in 1891 it was 176,628,000 cubic feet—an increase of 10,025,000 cubic feet, or 6 per cent. The quantity of cooking gas sold in 1890 was 37,106,000 cubic feet ; in 1891 it was 60,491,000 cubic feet—an increase of 23,385,000 cubic feet, or 63 per cent. Of gas for motive power, 12,337,000 cubic feet were sold in 1890, and 14,261,000 cubic feet in 1891—an increase of 1,923,000 cubic feet, or 15·5 per cent.

As it is now about ten years since I had the honour of being appointed Engineer to the Company, a retrospect of its progress during that time may be of interest. The quantity of lighting gas sold in 1881 was 86,091,000 cubic feet ; in 1891 it was 176,628,000 cubic feet—an increase of 90,537,000 cubic feet, or 105 per cent. The quantity of cooking gas sold in 1881 was 14,467,000 cubic feet ; in 1891 it was 60,491,000 cubic feet—an increase of 46,024,000 cubic feet, or 318 per cent. Of motor gas, 2,230,000 cubic feet were sold in 1881, and 14,261,000 cubic feet in 1891—an increase of 12,031,000 cubic feet, or 540 per cent.

The following is a statement of the number of meters fixed during the last ten years : Total number in 1881, 4535 ; in 1891, 11,770—an increase of 159 per cent. The annual expense connected with the repairs and maintenance of meters in 1881 was £331 ; in 1891 it was £609—an increase of 83 per cent. This shows that while the number of meters has increased 159 per cent., the repairs and expenses of maintenance have only risen 83 per cent. The capital at present sunk in meters amounts to £21,167, of which 7·7 per cent. is returned annually in the form of meter-rents, after deducting expenses of repairs.

It is generally assumed that, for a company to be considered prosperous, the consumption of gas should be doubled every ten years. Referring to the foregoing figures, it will be seen that this result has been more than attained ; and the Directors have reason to congratulate themselves on the extreme vitality and prosperity of the Company—a result obtained by few contemporaneous gas undertakings.

During the last half year, several of the Company's works have shown further large increases in the consumption ; amounting, in some instances, to 16 to 19, and even to 48 per cent. as compared with the previous year. This large increase serves to verify the opinion expressed in my previous report, that, fostered by low prices and a popular policy, there is practically no limit to the Company's business, especially in the direction of the use of gas for domestic purposes ; and much has been done by the Company to encourage the consumption of gas in this respect, by opening and maintaining the exhibition of gas cooking apparatus in the various towns, and having weekly demonstrations of practical cookery by attendants employed for the purpose.

At Frederiksberg, the policy of letting cooking-ranges on hire appears to be appreciated—upwards of 100 having been hired out since the plan was started a year ago ; and I am of opinion that a continuance of the plan should be extended to Odense, Randers, Aalberg, and Flensburg. The most signal effect, however, has been caused by the Company's policy in letting high-power lamps on hire. Since the Directors determined on this plan three years ago (and they were induced to do so from the effects of a personal visit to some of the Company's towns), the Company has hired out more than 1500 high-power lamps, principally on the Siemens, Westphal, and Schülke principle, representing a capital of about £4200, of which 10 per cent. is actually returned in the form of rent for the lamps. These lamps have worked wonders in popularizing the use of gas. They have also displaced many petroleum lamps, as it has been demonstrated that, in point of economy and lighting efficiency they can compete with the best petroleum lamps ; and to the costly electric light they prove still more formidable. As the duty has now been removed off the import of petroleum into Denmark, the competition with the constantly improved petroleum burner becomes still more severe ; and it is quite clear that gas consumed in an ordinary fishtail, or even a good Argand burner, cannot compete, in point of economy or lighting power, with a good petroleum burner.

The enormous increase in the Company's business is taxing to their utmost the resources of the several works ; and the question of providing the necessary capital to meet this business is a serious one. With gas both for lighting and domestic purposes at the present low prices (excepting in a few towns), the Company's business is on a sound and commercial basis, and an almost unlimited progress may be anticipated. The vitality shown in some few towns, especially Frederiksberg, has passed our expectations ; and it will be necessary for the Directors to turn their attention to the removal of the Frederiksberg works to a more commodious site, long before we are compelled to do so by an obligation to the Commune. The removal must, I anticipate, be effected within three years.

During the year the following work has been carried out, or is approaching completion. At Odense, four new ovens, containing 26 retorts, have been erected. Next year it will be necessary to pull down and rebuild the old bench of ovens ; these having been in use for about 20 years. Sundry new mains have also been laid. At Flensburg, the old retort-ovens on the south side of the retort-house have been pulled down and rebuilt in the form of five generator ovens, containing 35 retorts. At Frederiksberg, a considerable extension of the system of mains has been carried out ; and the supply of gas to the lower portion of the district has been greatly improved. At Randers, the leakage and unaccounted-for gas is gradually increasing, owing to the high pressure at which the works are compelled to distribute the gas. This is owing to the smallness of the trunk mains. If this is to be obviated, it will be desirable to increase the dimensions of the trunk mains next year.

The sale of residuals has been very satisfactory ; advanced prices having been maintained, and no stocks of magnitude, of either coke or tar, were on hand on the 30th of June.

In conclusion, I have to report that all the Company's works are in excellent repair, and supplied with coal to meet the demands of the coming winter.

Rhyl Water Supply.—The delegates of the Local Authorities of Rhyl, St. Asaph, and Abergele have decided that steps shall be at once taken with the view of promoting a Bill in Parliament for the compulsory acquisition of the Rhyl water undertaking, for the supply of water for domestic, general, and sanitary purposes within the respective districts of the authorities.

Gas and Electric Lighting Affairs at Halifax.—At the recent monthly meeting of the Halifax Town Council, Mr. Brook, in proposing the adoption of the minutes of the Gas Committee, mentioned that they were purposing to borrow £60,000 for gas-works extension ; the present works being nearly at the end of their productive power. The producing capacity was from 24 to 25 millions per week ; and already they had reached from 22 to 22½ millions. Mr. Brear seconded the motion. The Mayor (Mr. Alderman J. W. Davis), answering a question as to electric lighting, said the Electric Lighting Company, at their existing station, had reached the utmost extent of production of which they were capable ; and if a further supply was to be made by them, the works would have to be removed to another place, because they had no room for extensions on the present site. The Corporation had power at any time to take over the plant, pay out the Company, and start other works of their own. The Electric Lighting Committee, therefore, thought that the present would be an opportune time to acquire the plant, and begin supplying electricity. It would take about a year before they could get these powers ; and after that the question would come before the Council as to the extent to which electricity should be supplied. The minutes were adopted.

The Worksop Local Board and the Gas and Water Works.—The Worksop Local Board recently appointed a Committee to consider the question of acquiring the works of the local Gas and Water Companies ; and at the meeting of the Board on the 5th inst., the Clerk, on their behalf, reported that they had a meeting on the 2nd inst., when they had before them various particulars regarding the two concerns. Up to Dec. 30, 1890, the amount of capital expended by the Gas Company was £27,049. The ordinary shares amounted to £15,000, and the preference shares to £11,000. The dividends on the ordinary shares varied from 8 to 5 per cent. ; and on the preference shares, from 4 to 5 per cent. With regard to the Water Company, section 63 of the Public Health Act, 1875, empowered a water company to sell and transfer their undertaking to any local authority ; but the Worksop Water-Works Act contained the following in one the sections : "That if the Company and Local Board cannot agree upon the amount of the purchase-money, the terms are to be arranged by the arbitrator, the Board of Trade to appoint an umpire, and the cost of the arbitration to be borne by the Local Board." The amount of capital expended by the Company up to June 30 last was £17,419 ; and the present dividend on the shares and preference stock was 4 per cent. The Committee resolved unanimously to recommend the Board to defer the consideration of the purchase of the undertaking of the Gas Company for the present, and to ascertain the price the Water Company required for their undertaking. These recommendations were adopted.

MALVERN LINK LOCAL BOARD AND THE GAS COMPANY.

Proposal of the Board to Erect New Works.

At the Monthly Meeting of the Malvern Link Local Board last Thursday week—Mr. W. W. A. TREE in the chair—the Lighting Committee reported upon the question of the attempted purchase by the Board of the local gas-works. It recommended that further negotiations with the Gas Company should cease; and that the Committee be requested to at once take the necessary steps with the view of establishing and setting up works on behalf of the ratepayers. The correspondence, which was read, extending over a period of several months, went to show, first, the reluctance on the part of the Gas Company to name a price for the concern; then a detailed valuation of the works by two gentlemen on behalf of the Board, whose valuation, although acting independently, only differed by £110. An offer was then made by the Board to the Gas Company taking the mean between the highest and lowest of the two estimates, and which total amounted to a little under £4000. This sum the Company refused, and offered to accept the decision of two arbitrators. This proposal was accetped by the Board, subject to the condition that the terms of arbitration should be limited to the present structural value. This qualification the Company emphatically declined, and insisted that no limits whatever should be placed upon the valuation—that it must be taken upon its commercial value, and as a going concern.

Mr. YAPP, the Chairman of the Lighting Committee, moved the adoption of the report. He said the correspondence needed but little addition, as it spoke for itself. There were, however, one or two points in the last letter of the Gas Company he would briefly refer to. The Company said many instances would readily be found justifying the terms they had laid down. He had from their point of view been unfortunate; the cases which were on all fours with their own, and had come under his notice, bore the opposite construction. In August last year, the Liskeard Town Council passed a resolution declaring that the time had arrived when they should have the gas supply in their own hands, and requesting the Lighting Committee to consider and report to the Council the cost of putting up works for the supply of electricity or gas. There was a great deal in common between this case and their own. Not only did they repudiate any idea of goodwill—whatever that was, but they did not even propose to offer to negotiate with the Company as to the transfer of their site; and the further similarity was the absence of parliamentary powers. Burley-in-Wharfedale was another example where the valuation was limited to the structural value. The existing Company did not even dare to suggest such an absurdity as goodwill. The Paignton Local Board was a further instance justifying the course the Board had pursued. There could be no question of the desirability of the ratepayers having the gas supply in their own hands; and it came to this, that, as the Malvern Link Gas Company declined to sell their works, except upon terms which would be ruinous to the ratepayers, the Committee had determined to construct new works. He need hardly say that it would be to the interest of the ratepayers as such, and also in their capacity of private consumers, to support the Board's decision; for, in order to produce the light cheaply, the least possible necessary outlay must be incurred. By way of showing how impossible it was to get fair treatment from the Company, he could not do better than read one of their letters, which was received in answer to a request that they should extend their mains into Newtown Road. The letter said they could not for the want of capital undertake the laying down of mains, &c., unless they could obtain something like a guarantee that the shareholders would not be losers by the outlay; and the writer was instructed to inquire, "in the event of the Directors borrowing the necessary capital to lay the mains at once, whether the Board would pay interest upon the outlay at the rate of 6 per cent. including the interest on the loan, and a sum for depreciation." He had six additional instances where the gas undertakings had been transferred to the local authorities, which fully supported the action the Board had taken, and was also interesting as showing the cost per head of the population in the amount paid for the works, and would in this respect serve as a comparison favourable to the offer the Committee had made. At Aberavon, the figure was 13s. 4d. per head; Beverley, 19s. 10d.; Carnarvon, 21s. 2d.; Devizes, 20s. 2d.; Droitwich, 20s. 10d.; and Ripon, 28s. Now the average of these six instances was £1 os. 6½d. per head of the population; whereas the offer they had made to the Malvern Link Company amounted to nearly 40s. per head of the population, and therefore nearly cent. per cent. higher than the six towns he had named; and he was convinced, if they had erred at all, it was on the side of generosity to the Gas Company.

Colonel OTTLEY seconded the motion, which was carried unanimously.

A Water Scheme for the Hemsworth Rural Sanitary Authority District.—The Hemsworth Rural Sanitary Authority have decided to take the water supply of the whole Union from the Dewsbury Corporation, and have adopted a scheme which it is expected will cost about £28,000. A reservoir is to be made on Ring Stone Hill, at Hemsworth. The charge to the Hemsworth Union is to be 6d. per 1000 gallons; and the supply is to average 400,000 gallons per day.

The Mersey Aqueduct.—Three or four weeks ago the boring operations at Fiddler's Ferry in connection with the scheme for conducting water from Vyrnwy to Liverpool were suspended in order that an alteration might be made in the tunnelling shield, which it is thought will result in an increased rate of progress being made. It has for a long time past been a matter of comment that the tunnelling was proceeding at a very slow rate; and Mr. G. F. Deacon, the Engineer, thought it expedient that an attempt should be made to increase the rate of boring. The alterations are being carried on by the firm of Messrs. Pearson and Knowles, of Warrington, who also supplied the whole of the iron-work used in the construction of the water-tower at Norton. It is expected that the alterations will be completed in a few days; and these, it is hoped, will enable the boring operations to proceed with greater speed than formerly. The low rate of speed, and the advisability of making the alterations now in progress, arise from the extremely difficult nature of the strata being bored through.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Water Committee's Recommendations Adopted.

At the Meeting of the London County Council last Tuesday—Sir J. LUBBOCK, Bart., M.P., in the chair—the debate on the report of the Special Committee on the London Water Supply (see *ante*, p. 629) was resumed. The Committee's recommendations were given in full in the JOURNAL last week, together with certain amendments thereto proposed by Mr. Beachcroft. These were discussed *seriatim*.

The first recommendation was to the effect that the Council were "unable to accept the condition contained in the recommendation" of the Select Committee of the House of Commons—that, if constituted the Water Authority, they should be required to purchase the undertakings of the eight Water Companies "by agreement, or, failing agreement, by arbitration within a fixed period." To this Mr. Beachcroft had moved an amendment to insert the words "without further inquiry" after the word "unable."

The VICE-CHAIRMAN (Sir T. Farrer) asked permission to treat Mr. Beachcroft's three amendments as a whole. He said their proposer seemed to think that the report of the Water Committee was more hostile to the Government than it ought to be. However, it did no more than state the facts; and if the Government found them disagreeable, it was the fault of the facts, and not of the Committee. Mr. Beachcroft last week said that, if a general inquiry into the water supply were needed, the better course to have pursued would have been to get one of their representatives in the House of Commons to move for it. He (Sir T. Farrer) did not think that, after they had made an application to the Government, in which they left it entirely to them to institute an inquiry, either in the House of Commons or elsewhere, and after the way the Government had treated that application, it would be of any use for one of their members to move in the matter in Parliament. Coming to the amendments, the first was a very innocent-looking one; and if it stood by itself, he should have no objection to it. The Committee of the House of Commons passed a positive resolution without any qualification; and to that resolution, as it stood, the Committee demurred. If, however, the amendment were considered in connection with subsequent recommendations, it did not appear quite so harmless. In his second amendment, Mr. Beachcroft proposed to leave out certain words with reference to the future liabilities of the Water Companies. To omit these words altogether would be to reverse the whole policy of the Council. What had that policy been? It was this: To ascertain what they were going to buy before they bought it. They desired to find out whether the existing supply was a permanent one, or whether it would have to be largely supplemented, at enormous expense, from other sources. Surely, it needed no argument to show that this was a most important element in the matter. Mr. Beachcroft asked: "If a new supply costs (say) £20,000,000, do you propose to deduct this amount from the price you will pay the Companies?" The Committee had never said anything of the kind. What they had said was that the raising of the additional capital under the conditions Parliament now imposed involved, for a considerable time, loss to the Companies—that was, it took, for the payment of interest and for instalments to the sinking fund, part of the rates that would otherwise have gone to augment the dividends. They therefore said that this ought to be taken into account in considering what was the value of the property they were to purchase. He would give an instance from the history of the Southwark and Vauxhall Water-Works Company. The matter was last year put before the Committee by the Chairman of the Company himself. He said that in the year 1876 they raised a sum of £300,000 under certain conditions; and he gave it in his evidence that the raising of that amount would cause an actual loss to the Company for 20 years, and that the sum would not be recouped for the next 40 years. What, then, would be the loss to the Companies if they had to raise (say) £20,000,000 for a new supply. It would certainly be a considerable loss. Mr. Beachcroft wished to know exactly what were the statutory liabilities of the Companies with respect to the supply. The first answer to be made was that an inquiry into the subject was unnecessary, as the Companies had themselves given what they considered their liabilities to be. They had admitted that they must, under the provisions of their Special Acts, "bring pure and wholesome water" to every part of their districts requiring it. He did not think the liabilities of the Companies were to be measured by statutory penalties. The position was this: They undertook, as a condition of their concessions, to supply the Metropolis with water; and if they failed to so supply it, the very foundation of the concession collapsed. If they failed, the consequence was not merely the infliction of statutory penalties, but, as he thought, the forfeiture of their privileges, and the introduction, almost by necessity, of a competing supply. If, by his third amendment, Mr. Beachcroft merely intended to suggest that, in case purchase was found impracticable, there was an alternative to be considered—viz., amalgamation, with effectual control—he (Sir T. Farrer) would not be indisposed to agree with him. For instance, a scheme of amalgamation might be proposed involving a reduction of the present absurdly large staff of Directors, which now cost £26,000; a reduction of the ordinary staff; the utilization of all plant in common; a general distribution of water from all sources; the provision of a new supply, and the appropriation of new gathering-grounds; the equalization of charges and rates; the abolition of the increase on the quinquennial valuation; a scheme, as in the case of the Gas Companies, for dividing profits between the Companies and the consumers; and a provision for the economical raising of fresh capital. Such a scheme would deserve consideration; but there was a great deal to be said on the other side. Was it not too late for such a scheme? Had not the opinion of London been pronounced in favour of acquisition? Again, any such scheme must come from the Companies themselves. Then there was the question of competition; and he wished to face it fairly and squarely. He thought it was admitted that the Water Companies had no absolutely legal claim to a monopoly. Many persons supplied themselves with water from wells; and there was nothing that he knew of to prevent them supplying their neighbours also. But the Companies held a strong position, having

alone the power to break up the roads. Moreover, it would be extravagant to supply the householder with new fittings; therefore, physically and financially, the Companies had something like a monopoly. Mr. Pember, the Counsel for the Companies at the recent inquiry by the Parliamentary Committee, put the case of monopoly or purchase at monopoly prices upon parliamentary precedents. Of course, the precedents of Private Bills were not to be compared with the precedents of the Law Courts. A great deal of legislation in the past was due to the enormous preponderance of the joint-stock interest in Parliament; but he did not think this power was as great now as it had been. Indeed the way in which Parliament had recently dealt with railway rates was a thing he never could have anticipated. Moreover, precedents did not go all one way. Mr. Cardwell reduced the Gas Companies to terms by threatening to pass a competing Bill; and Sir William Harcourt's Committee had said it might be necessary for London ratepayers to have recourse to competition in the case of water. However, what were the precedents quoted? First, there was the Birmingham case; but the results of that case were most advantageous to Birmingham, which had made a great deal of money over the transaction. That case was no precedent at all. Then there was the Stockton case. There the Company were supplying the town with tainted water, and they proposed to extend that supply; whereupon the Corporation arranged to compete. What did Parliament do? It insisted upon their buying up the existing undertakings; and gave the Company the full value of their maximum statutory dividends at 20 years' purchase, with compensation for prospective interest. The whole capital of the Company was £360,000; and 20 years' purchase was equal to £466,000. The compensation for compulsory purchase and prospective interest amounted to £213,000. So that that unhappy town had to pay to the defaulting Company £679,000 for a capital of £360,000. If this was a precedent, heaven help London! It was a precedent that ought to be relegated to the limbo of bad and unjust decisions. He did not attribute that argument to the Water Companies themselves. He found that they rested their case on the statement that they were supplying London properly with water; and this was a fair ground. Let the Council just think what the Stockton precedent meant. Water Companies would only have to supply impure water to compel the towns to buy them up at exorbitant prices. He did not wish to use any extravagant arguments, but many very awkward questions could be asked if matters like the Stockton "precedent" were to be discussed. How was it, for instance, that when they had done away with all other monopolies without compensation, the monopoly in water was to be sacred? Was it because water was a primary necessary of life—the primary thing needed for the health of our swarming town populations? or was it because the shares of water companies were held in high places? After the decision of Sir William Harcourt's Committee, he did not think that the Council would be doing their duty to the inhabitants of London were they to do anything to sacrifice one iota of their right to introduce a competitive supply, if such a thing should prove to be necessary. On the other hand, he sincerely hoped and believed such a thing would not be necessary. After all, the most important question before them was not what they should give to the Companies. The most important question was, how should London be supplied with water? Therefore he sincerely hoped the Companies could prove up to the hilt that they had an ample supply for 50 years. It would be cheaper to buy out the Companies' works at their full value, than to go a long distance for a new supply. It was a miserable thing that the different populations of this country should be left to scramble for the various water areas of England. It was desirable that there should be some plan arranged by which areas could be appropriated to the several districts in proportion to their wants. This could not be done by the Council—it could only be done by, or under the influence of, the Government; and it was with this view that the Chairman last year approached Lord Salisbury. He trusted the Government would yet see their way to do something in the matter. It was his most hearty wish that, in some way or other, the great water question might be taken up by those who were able and competent to grapple with it, and to deal fairly with the water companies on the one hand, and the inhabitants of London and of the great provincial towns on the other.

Mr. BOULNOIS, M.P., as one of the "absurdly large staff" of Directors of the Water Companies, said he had sat in the Council Chamber during many discussions on the question of water supply, and had hitherto been absolutely silent. Upon the very important report under consideration, however, he felt that he ought to make a few observations. He was sorry the report had been brought up in such a manner——

Mr. J. BURNS rose to a point of order, and asked whether Mr. Boulnois was speaking for his constituents, or for the Water Companies. He was under the impression that Mr. Boulnois had no right to abuse his capacity as a representative of the people on this question.

The CHAIRMAN: That is not a point of order. It is not for the Chairman to rule in what capacity any member may speak.

Mr. BOULNOIS said he was not in the least ashamed of being a Water Company's Director; and if his constituents thought that his being one and also a county councillor were incompatible, they had the remedy in their own hands. As he was saying, he regretted that the report before them had been framed in a spirit calculated to delay, if not altogether to frustrate, the object the Council had in view. There was a spirit of hostility—almost of defiance—to the Water Companies. There were suggestions that there were matters behind, of which the public were ignorant—that the Companies were not fulfilling their obligations, and would not be able to provide for future wants. This was not the best mode of arriving at a friendly solution. He believed that if the Companies had been approached in a different attitude, much waste of money would have been avoided, and irritation and suspicion would not have been engendered. There was a spirit of confiscation throughout the whole report. It was all very well for the Chairman of the Committee [Sir T. Farrer] to say he did not mean anything of the sort, and to write to *The Times* and argue that the Committee did not mean it. But anyone studying the report, and reading it by the side of other reports, must see that the object was to depreciate the property of the Water Companies, and to endeavour to acquire it upon terms which were not recognized between a buyer and a seller who was not compelled, and therefore was not anxious, to part He had no authority to speak on behalf of the Water Companies; but he believed their temper to be that, if Parliament determined that the control should pass to any public authority, they would offer no hindrances, provided the arrangements were based upon fairness and equity; but that, if any unjust attack were made upon their property, they would resist to the utmost, and would defend it with all their ability and strength. The Londoner must decide the question, which had not yet been brought before him. The advocates of the change must show that the transfer from responsible corporations, who had the authority of Parliament at their back, and were controlled by a Government Department, with £40,000,000 sterling as their capital and as security to the public, to an irresponsible municipality, whose only claim to the confidence of the ratepayer was, "how not to do it," would benefit him either in the article supplied or in the price paid for it.

Mr. RHODES argued that the amendment on the first resolution was quite superfluous. There was no question of confiscation involved. At the same time, certain of the Companies having known some time ago of the proposed municipal purchase, had failed to renew their plant, and had abstained from building up reserves; and these matters should, he contended, be taken into account in considering the question of value, and the figures ought not to be arrived at merely on the basis of the Stock Exchange quotations. He was quite sure they would never see their way, or wish to see their way, to acquire the Water Companies' property in the public interest for other than what was a fair and equitable return.

Mr. ARNOLD warned the Water Companies that, if they adopted an attitude of hostility, it would not be to the disadvantage of the people of London, but only so much the worse for the Companies. The authority must purchase only that which was valuable to the people of London. There were intakes of water on the Thames and elsewhere which ought to be declared illegal and improper; and to call upon the people to pay value for the privilege of taking water where it ought not to be taken, was a matter to which he could never consent. The only body which could have a monopoly for the supply of water was the local authority; and he held that the authority of every district ought to possess that monopoly. If they had water of the same quality and degree of hardness as that used in the North, they would save 4,000,000 lbs. of tea and 4,000,000 lbs. of soap in the Metropolitan district. This represented £500,000 a year; and this saving capitalized would come to nearly £12,000,000 sterling, which, with the saving that might be effected in chemicals, &c., would easily bring up the value of a better water supply to London to a capital sum not far short of £20,000,000 sterling.

Mr. DICKINSON remarked that the recommendations of the Committee had been brought forward in order to get the view of the Council upon broad questions of principle to lay before the Committee of the House of Commons at some future period. It was not a mere matter of price that had to be put before the Committee, but what was to be the basis upon which the purchase was to be effected. The Water Companies must understand that the representatives of the ratepayers of London, in acquiring vast concerns, would insist upon knowing that they were worth the money they were paying for them.

Mr. DOUBLEDAY urged that, before any value was put on the Companies' works, the Council ought to know what they comprised, in what condition they were, whether they could supply enough water, and whether the mains and machinery were in sufficiently good condition to last for years.

Mr. STUART, M.P., thought the real point of Mr. Boulnois's argument was that there was something in the nature of spoliation in the proposals and in the intentions underlying the proposals of the Committee. He ventured to say that there had not been the shadow of an argument brought forward to show that this was the case. They wanted to know not only what the article was that they were about to buy, but what were the obligations lying upon those who were to sell it. It was clear that, if the Companies were not able to supply a sufficient quantity of good water for the districts which they respectively served, one of two things would have to happen. Either they would have to go further afield, and lay out capital in order to get additional supplies, or they would have to admit not only the liability, but the necessity of a competing system. Under either of these alternative admissions, the value of the Companies' property, which they were about to purchase, would be seriously affected; and this was surely a most reasonable position for the Council to fully consider.

After some further discussion, the amendment was negatived on a show of hands, and the recommendation was agreed to; as was also the second. On the third recommendation, dealing with the price to be paid for the undertakings, it was proposed that the stipulation that "this is in each case to be upon the true value of the undertaking, having regard to its legal position and liabilities," should be amended by altering the latter portion of the clause to "the liabilities as well as the privileges of its legal position." Considerable opposition was, however, shown to altering a carefully-prepared resolution, and to admitting that the Companies have any privileges; and in the end the amendment was withdrawn. The third recommendation was then submitted as follows: "3. That the Council is of opinion that the price to be given for the undertaking of any company should depend, not merely on past dividends or on Stock Exchange values, but upon the true value of the undertaking, having regard to its legal position and liabilities, to the condition of the property, and to its ability to supply future wants."

Mr. BEACHCROFT then moved, as an amendment—"To omit from the third recommendation the words 'and to its ability to supply future wants,' and to substitute the following words: 'And that the Committee be authorized to inquire and report to the Council as to what are the present statutory obligations on the Companies to provide and supply water, so that the Council may be informed whether the cost of supplementing existing supplies, if such should be found necessary, ought fairly and reasonably to be taken into account in determining the present purchase value of the Companies' undertakings.'" He said he was not a holder of a single water share, but he believed the Companies had always been ready to treat for the purchase of their undertakings at their fair value. If, however, the words he wished removed were retained, there would be no more chance of the Council becoming

the Water Authority than there was 20 years ago. They were treating the Companies as if they were thieves and vagabonds.

Mr. ANTROBUS seconded the amendment. He said he had always been one of those who voted in favour of the Council being the Water Authority for London; but he was getting inclined to modify his position on that point, as he saw how the subject was being treated. Whatever the ratepayers might be able to do, they at least could not afford to approach the Companies with any proposal that would not bear a thorough examination as to fairness. This, in his opinion, the report of the Committee would not do.

The DEPUTY-CHAIRMAN (Mr. Haggis) said the last eight words of the resolution were as plain and clear as they could possibly be. It had been seen by the Committee who had this matter under their investigation that this question as to the supply of "future wants" was the largest and most important factor in the problem before them; and they felt that there was an immense responsibility resting upon the Companies in regard to this particular matter. The Council wanted to ascertain what that liability was—not in order to deduct it from the value of the Companies' stock or property, as Mr. Beachcroft would suggest, but to see what the effect of a large outlay of capital expenditure would have upon the dividend and upon the value of the property itself. It had been admitted that day by Mr. Beachcroft himself that the Companies acknowledged to the fullest extent their liability in the matter. They were bound to supply water of a pure and wholesome character throughout the whole of their districts. There was no limit to that as to time; it was to go on in perpetuity. As long as the Companies existed, they had this liability constantly before them; so that there was no occasion to inquire into the matter at all. They had each of the facts before them, and knew exactly how far the liability of the Companies extended. Why were the Committee so anxious on this question? The population of London and the surrounding districts was growing to an enormous extent and at a very rapid rate; and this was the cause of their anxiety as to the sufficiency of the supply for the Metropolis.

The amendment was negatived on a show of hands. A division having been claimed, the numbers were: For the amendment, 17; against, 68—majority against, 51. The recommendation was therefore agreed to.

On the fourth recommendation,

Mr. BEACHCROFT moved to add the following words: "And that, in view of the contingency of no terms of purchase being possible, and of Parliament supporting the opinion of the Select Committee of the House of Commons that purchase of the Companies' undertakings must precede the establishment of an independent supply, it is essential that the only alternative plan of solving the problem—viz., the one suggested to the Select Committee, on behalf of the Companies, of amalgamation of the eight existing Companies, accompanied by more complete control and increased obligations in regard to supplementary supply—should be taken into consideration.

This amendment was also defeated—only two hands being held up in its favour; and the recommendation was agreed to.

It was then resolved that copies of the report and of the recommendations should be sent to the various Metropolitan Local Authorities, the Water Companies, and others.

Commenting on the proceedings above reported last Wednesday, the *St. James's Gazette* said: "The London County Council is nothing if not aggressive and partisan; and even when discussing such a question as the water supply, many of its members seem unable to divest themselves of the idea that it is their duty to attack somebody or something. It would probably not be at all difficult for a sensible and practical body of men to arrange equitable terms with the Water Companies for the purchase of their undertakings—assuming that it would be an advantage to London for a public body to manage the water supply; but the worst way to go to work is to abuse the people with whom you wish to do business, and give the impression that you intend to drive a hard bargain. The Water Companies can supply the present population of the Metropolis well enough; and nothing can be more unfair than an attempt to depreciate the value of their property by suggesting that some time hence, when the population has greatly increased, new sources of water supply will have to be tapped. This may be true enough, but it is beside the point; for if the Companies can meet the demands of five millions of people, the fact that they may be unequal to the needs of seven millions cannot, on any rational supposition, affect the present value of their undertakings."

THE BIRMINGHAM CORPORATION WATER SCHEME.

The Estimated Cost—The Committee Authorized to Promote the Bill.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Mr. Alderman Clayton) presiding—the Water Committee presented a report on the new water scheme, the principal portions of which were as follows:—

Under instructions from the Water Committee, given in pursuance of the resolution passed by the Council on April 21 last, Mr. James Mansergh and his assistants have been actively engaged upon, and have now completed, the detailed survey for the works necessary to carry out the Elan and Claerwen scheme. The completion of this survey has now placed him in a position to submit estimates of the cost of the works; and the Water Committee are, therefore, able to lay before the Council figures showing the outlay, which, according to the best calculation that can be made, will be necessary for the undertaking. It is proposed that the first instalment of the works shall comprise the completion of the tunnels, of the cut-and-cover work, and of three of the reservoirs, but shall only provide two out of the proposed five lines of pipes. These will be sufficient to give a daily supply of 26 million gallons. Mr. Mansergh estimates that the cost of the first instalment will amount to £3,340,700. If the full scheme, involving the construction of the three additional reservoirs and all five pipes, should be carried out, the ultimate cost of the whole is estimated to amount to £5,654,953. In a report by Mr. Gray, these figures are confirmed. Mr. Gray also deals with the local requirements—the works which, under any circumstances, whether the Welsh scheme be adopted or not, are necessary for the better supply of the high-level districts, the provision of additional mains for supply in new streets (which is continually going on), and any improvements that may be necessary in the existing works pending the construction of the new ones. The total outlay up to and including the year 1900, by which time it is expected the first instalment will be completed, will, according to the several estimates, stand as follows: Elan and Claerwen scheme, £3,340,700; reservoir and works for local high-level districts, £86,250; new mains and improvements, £195,000—making a total of £3,621,950. To show how the burden of this outlay and of that which will be required for future instalments of the works can be met by the available resources of the department, Mr. Mansergh has prepared a new table, which has been submitted by the Committee to Messrs. Howard Smith, Slocombe, and Co.; and they have expressed an opinion that it is substantially correct. It will be seen from the table that a reimposition of charges amounting at the outset to £28,000 a year will be necessary, and that it is suggested it shall begin in 1892. If the forecast shown in the table is correct, the increase in the charges must be maintained until 1918, when it will cease. And it will be unnecessary to reimpose any part of it in order to provide for the outlay on the third and fourth instalments of works (if these should be required), as the natural increase in the rental will be sufficient to cover the annual cost occasioned by the outlay on these instalments. According to the forecast, the annual deficits on the revenue account will disappear in the year 1926, when a small surplus of income over expenditure is anticipated; and after that year, this surplus is expected rapidly to increase. Mr. Mansergh's table is based on a somewhat more moderate estimate of the growth of the water rental than that of Messrs. Howard Smith, Slocombe, and Co., in their report laid before the Council in April last. Instead of adopting a uniform rate of 3 per cent. for each year, he estimates the increase to be as follows: From 1890 to 1900, 3 per cent.; from 1900 to 1910, 2¾ per cent.; from 1910 to 1920, 2½ per cent.; from 1920 to 1930, 2¼ per cent.; and from 1930 to 1940, 2 per cent. This estimate will, no doubt, be accepted as cautious and safe. But it will be borne in mind that if, contrary to all reasonable expectation, even this rate of increase should not be reached, there will also be a corresponding reduction in the rate of increase of water required; and it will therefore be possible to postpone some of the future instalments of works.

The Committee have requested Mr. Mansergh to prepare the necessary plans and sections for deposit in Parliament in the ensuing session. The referencing between Rhayader and Birmingham was commenced in July last, and is now nearly completed; and the referencing of the land on the watershed is in active progress. The Committee have been advised to retain the services of Sir Frederick Bramwell, Messrs. Hawksley, and other eminent engineers and experts, to support the Bill by evidence in Parliament; and these gentlemen have already had an opportunity of going over the line of conduit and visiting the site of the principal works. The Bill is already drafted, and will be laid before the Council as soon as it is finally settled. From the figures above submitted, it appears that the scheme, which is now based on careful and detailed estimates, is financially feasible; and as the Committee from all the further consideration they have given to the subject, and from the advice they have received, are more and more convinced of the desirability of adopting this great project, they have no hesitation in recommending the Council definitely to approve it, and to authorize them to take all necessary steps for the promotion of the Bill in Parliament, and to do all acts consequent thereupon, including the entering into provisional agreements for the purchase of lands and easements, and for the employment of such professional and other assistance as may be necessary or desirable.

The following is the summary of the approximate estimate prepared by Mr. Mansergh:—

Description of Work.	For two Lines of Pipe.	For five Lines of Pipe.
Railway	£45,000	£65,000
Reservoirs	634,000	1,265,000
Aqueduct	1,698,000	2,746,000
Service reservoirs and filters	179,225	328,062
Land for reservoirs on watershed	120,000	200,000
Land for aqueduct (easement) and for Frankley reservoir and filters	115,680	115,680
Mains to Monument Lane and city boundary	113,072	243,258
	£2,904,977	£4,963,000
Add 15 per cent. for contingencies, &c.	435,723	—
Add 10 per cent. on £1,050,000 (third, fourth, and fifth mains)	—	105,000
Add 15 per cent. on £3,913,000	—	586,953
Totals	£3,340,700	£5,654,953

Alderman Sir THOMAS MARTINEAU introduced the report of the Water Committee, and moved that the scheme for obtaining a supply of water from the Rivers Elan and Claerwen should be approved, and that the Committee should be authorized to take all the necessary steps for the promotion of the Bill in Parliament for giving effect to the scheme, to enter into provisional agreements for the purchase of land and easements, and to employ such professional and other assistance as they might deem necessary or desirable. He said that the resolution the Council passed in April last did two things—it showed a provisional approval of the scheme, so far as to give the Committee sanction to obtain the necessary estimates, and it empowered them to proceed in the meantime with such preparations as were necessary for the Bill. Mr. Mansergh's financial estimate gave both the ultimate cost of the whole scheme and the cost of the first instalment. The first instalment was to provide three reservoirs on the site in Wales, the channels and the cut-and-cover work for the complete scheme, and two out of the five lines of pipes; and the Committee were advised that this provision would be sufficient to deliver in Birmingham as much as 26 million gallons per day. The total cost of this first instalment Mr. Mansergh had estimated at £3,340,700; and the estimate included £435,728 which had been added for contingencies, being at the rate of 15 per cent. on the sum of the detailed items. This

allowance would be enough, they were told, to cover the parliamentary costs, the engineering expenses up to the time when the first instalment should be ready, and those numerous and indefinable contingencies which were certain to attend the execution of any great work. To Mr. Mansergh's estimate of the cost of the Welsh scheme proper, some additions had to be made in respect of expenses which would fall on the Water Department, whether or not there was a Welsh scheme. For many years past, for example, the department had had to incur heavy capital expenditure every year in laying down mains in new streets; and, indeed, the continuance of such expenditure was part of the case they had to lay before Parliament, because, of course, they affirmed a prospective increase in the water supply as their reason for seeking a new source. Also, during the ten years which must elapse before the supply from Wales could be utilized, certain improvements would have to be made in the existing works. Therefore, the Committee had allowed for the next ten years £195,000 as the cost of improvements to the present service of mains, and £86,250 as the probable cost of two new reservoirs, at Warley and Northfield. These latter, or some equivalent to them, had always been contemplated; and the Committee had been waiting until they should have to bring in a Bill for other purposes. The necessity for them was due to the fact that the department had never yet had a reservoir at sufficient altitude to give by gravitation the requisite pressure of supply for the highest districts of the borough. These two sums brought up the total estimated cost of the first instalment to £3,621,950. A good deal had been said as to the chance of the present rate of increase in the demand ceasing; and it appeared to have been thought by some persons that the Committee took rather a sanguine view when they submitted their first report. But if the very worst should happen—if it should turn out that the population of Birmingham, and of the whole water district, ceased to increase—the result would merely be that it would be never necessary to proceed with the future instalments. They were only prudent, however, in calculating the outlay to which they were likely to be subjected in the contrary case. Mr. Mansergh had made the calculation according to the history of the city, and to his very large experience of what had happened in similar cities. According to him the second instalment—another pipe and possibly a reservoir—would be wanted about the year 1908; and they would have to begin the work in 1904. The third instalment would become due from 1915 to 1921; and the fourth from 1928 to 1932, or somewhere about forty years hence. He asked the attention of the Council to the figures presented by Mr. Mansergh and Mr. Gray in the report now before them. They would remember that a former table of calculations, submitted in April last by Messrs. Howard Smith and Slocombe, was framed on the supposition that they had an expenditure to face of £4,000,000, and that this expenditure would be made within ten years, and would then stop. It was calculated that the burden of this outlay might be met by adding to the water-rentals a sum of £24,000 a year; and it was shown that by the year 1910, they would be realizing a surplus, which would thereafter steadily increase. In the calculation now submitted, they had to deal with two items—viz., the immediate and further instalments of the Welsh scheme, and the cost of immediate local requirements. The table was carried much further forward than Messrs. Howard Smith and Slocombe thought it necessary to go. Their scheme ended with the year 1914; whereas Mr. Mansergh's table was carried on to 1940, the whole period of fifty years for which they were making a forecast. The table also showed a clear separation of the capital needed for the Welsh scheme, and that for the local requirements; and there were some important alterations, not only in the form but in the material of the table. The first, and most important, was that Mr. Mansergh had not taken the prospective increase in the water-rental at the same amount as the Accountants had done. Messrs. Howard Smith and Slocombe considered that they might take the prospective increase at 3 per cent. per annum—each year being 3 per cent. more than the previous year—during the entire period covered by the forecast. Mr. Mansergh had taken 3 per cent. as the rate of increase for the first ten years; and then he dropped by ¼ per cent., until at last he got down to a rate of increase of only 2 per cent. annually. Since 1876, when the Corporation acquired the water undertaking, the total increase in the rental had been as much as 4½ per cent. per annum, and this was very large. In 1887, the increase was 2·56 per cent.; in 1880, 3·03; in 1889, 3½; and in 1890, 3·67 per cent. These figures would show that Mr. Mansergh had been actuated by a desire to be on the cautious side; and he (Sir T. Martineau) thought that his calculations in this respect might be taken as perfectly safe. Mr. Mansergh's conclusion was that it would be necessary to make an increase in the water charges beginning in 1892, not of £24,000 per annum as originally estimated, but of £28,000. This was a good deal short of the £33,000, of the reduction which had been made from the amount which the consumers were paying at the time the Corporation took over the Water Department. The table further showed that this payment must be continued till the year 1918, when it would cease; and there would be no necessity to reinforce any part of it for the third or fourth instalments of the work, the cost of which would come out of the accumulated balance which they would then have in hand. The table further showed that, when the fourth instalment was carried out, the increase of their balance would be so rapid as to afford them the means of making large reductions in the water-rental. As to the preparations which they were making for their parliamentary campaign, it was not desirable that he should enter into detail on the subject. They had, however, been in frequent communication with the engineers, and the latter had completed their surveys in a way which he believed was admirable. They had found it necessary to retain a large number of men, who were eminent in their profession, to give evidence for them before the Parliamentary Committees; and they had thought it desirable to allow them to make a visit to the watershed during the autumn, so that they might have the benefit of any suggestions they had to make before the parliamentary plans were actually deposited.

Mr. SHAMMON seconded the resolution.

Mr. FALLOWS, in supporting the motion, said that a scheme which would have provided for a few years might have been carried out at a cost of about £600,000; but as ultimately they would have had to go to Wales, such an expenditure would only have been wasted.

Mr. JACOBS asked a number of questions, and urged that, in view of the magnitude of the scheme, the Council should take two months longer to think about it. He thought it was unfair to increase the water-rates for the benefit of future consumers.

Mr. SHAMMON supported the motion, and said that if they did not get this Act of Parliament, he did not know where they would look for the increased supply that was fast becoming necessary. A delay of two months probably would be fatal to the scheme.

Mr. ALLEN, while agreeing as to the necessity for a purer and more ample supply, asked if it would not be possible to reduce the first expenditure by constructing tunnels, &c., only sufficient for the two pipes required for the necessities of the next few years.

Mr. WILDERS supported the scheme, not only on the ground that had been mentioned, but also because, as Chairman of the Watch Committee, and previously Chairman of the Fire Brigade Sub-Committee, he had reason to know that the pressure and supply in many parts of the city were altogether inadequate for fire-extinguishing purposes.

Mr. FULFORD remarked that the reductions that had taken place in the water-rates were largely on small-house property. If £28,000 of this remission were reinforced, he presumed that it would fall heavily on this class of property.

Alderman WHITE and Alderman Dr. BARRATT strongly supported the scheme.

Mr. DAVIS agreed as to the necessity of supplying working people with plenty of pure water; but he pointed out that a working man, living in a small cottage, used a great deal more water than a person in offices for which he was rated at £50 or £100 a year. He should like to know what the incidence of the additional rates would be. It seemed to him that it would be largely on small house property, and would indirectly press upon the working classes.

Alderman BAKER observed that, if they did not pass the resolution that afternoon, they would lose a whole year, as the parliamentary notices had to be given within the next few weeks.

Alderman Sir T. MARTINEAU, in reply, said that the water-rentals remitted in 1881-4, if they had still been charged, would now be producing £33,000 a year. It was true that these remissions had not largely affected the small house property; but as the result of recent legal decisions the £28,000, which it was now proposed to reimpose, would fall pretty generally upon all classes of water consumers. In fact, the greater part of the difference between the £28,000 and the £33,000 would be in favour of the smaller houses. As to Mr. Allen's suggestion, the most extravagant course the Council could take would be to adopt it. It would mean doubling the heaviest item in the cost of the scheme. Referring to some criticism by Mr. Jacobs, Sir Thomas pointed out that the area of the water supply extended far beyond the city boundary, and that the population in that area was increasing by the overflow from the city. They would probably have several applications in the future for the water to be laid on to places they were bound to supply.

The motion was carried *nem. con.*; and the report of the Water Committee was approved.

The Danger of Electric Lighting.—By a fire which occurred at the central office of the Bournemouth Telephone Office last Tuesday, the whole of the telephonic communication in Bournemouth, and with Southampton, Poole, and other places was suspended. The telephone officials state positively that the fire was caused by an electric light current, through contact with an iron roof standard to which the electric light wires were fixed. It fused the wires and brasswork in the telephone office, damaged a great number of wires, and set fire to the woodwork in the office.

The Northwich New Water-Works.—It was announced at the last meeting of the Northwich Local Board that the loan account in connection with the Cote Brook water-works was now closed; the amount expended since it was opened, five-and-a-half years ago, being £49,222. The works now in progress at Cote Brook, which have for their object the purification of the water, will probably bring the total outlay on the scheme up to £50,000. All further expenditure in this direction will have to be met by a call on the general district rate. It is satisfactory to note that, although during the past year the Board paid back £1080 as an instalment of the loan, together with £1960 for interest, the district rate has not risen beyond the average of the last five years. The profit on the water undertaking during the year was £1703. It is hoped that the new works at Cote Brook will soon be completed.

The Gas Question in the Salford Out-Districts.—A meeting of the Eccles Local Board was held yesterday week, for the purpose of considering their present position in regard to the gas question. The Clerk read a report from Mr. Corbet Woodall, respecting two sites for the proposed new gas-works—viz., a plot of land adjoining the railway; and another plot opposite the Bridgewater Foundry. He recommended the acquisition of the former plot, which was near to the railway sidings, though the other had the advantage of being close to the canal, which tapped several important collieries. A heated discussion, lasting two hours, followed, in which some of the members strongly complained of being kept in the dark with regard to the Committee's intentions in promoting a Bill to acquire powers for gas supply, contending that they had exceeded their duties. Certain members, on the other hand, said the Committee had only done what they were authorized by the Board to do; and that in due time a statutory meeting of the ratepayers would be held. A resolution was moved, and seconded, to the effect that an Executive Committee be appointed for the purpose of communicating the decision of the Gas Committee to the Swinton and Pendlebury Local Board through the executive of that Board. An amendment was proposed—"That no further action be taken to promote a Gas Bill until the consent of the ratepayers in public meeting has been first obtained." On being put to the vote, five were in favour of the amendment, and five against it. The Chairman gave his casting-vote in favour of the resolution. A further amendment was moved—"That the Gas Committee be instructed to obtain, with the assistance of the Parliamentary Sub-Committee, a full report as to the position of the gas question; and that, at the earliest opportunity thereafter, a statutory meeting of ratepayers be convened, and an entire scheme be submitted for approval or rejection." This amendment was carried.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

St. Andrews is not to be blessed, or the opposite (according to the view which one takes of the public owning of gas undertakings), with the transfer of the local Gas Company to the Corporation. The agitation for the transfer was begun so far back as September, 1888. It was headed by Provost Paterson, who was then a Director of the Company, and who got into trouble, even into litigation, with his brother Directors, on account of his eagerness to have the transfer effected. The municipal election of that year turned upon the question which he had raised; and the community backed him up—returning ten out of eleven Town Council candidates favourable to his proposal for the adoption of the Burghs Gas Supply (Scotland) Act. Notwithstanding this strong support, he has been unable to make headway with his scheme, the foundation of which was that the Company might be taken over for a payment of £13,250. The Gas Company have gone on flourishing; and I suppose he sees it is now hopeless to expect that they would part, or be obliged to part in the event of arbitration, with their undertaking at that figure. The matter came to an issue on Tuesday night, when a special meeting of the Town Council was held to dispose of it. The Provost himself was the leader of the opposition to his own proposal He observed that a remarkable increase in the prosperity of the Gas Company had taken place since the motion to take over the gas supply was adopted by the Council; and he moved a resolution to the effect that, seeing that the Gas Company had sent no reply to their letter of July 25, 1889, asking whether they were disposed to accept the sum of £13,250, and considering that the great advances since made in the science of electric lighting rendered it extremely probable that that system of public lighting would soon be generally adopted instead of gas, they agree not to confirm their former resolution. This motion was unanimously agreed to. I do not doubt the wisdom of the resolution, for the town is well served by the Gas Company. A good quality of gas is supplied at a low price, in both of which items of management the Corporation could not expect to excel the Company. In these circumstances, there is no call for taking over the gas supply. Provost Paterson's reasons are not, however, such as will bear much scrutiny. So far as electric lighting is concerned, he seems to have been scared by a bogie. St. Andrews is not a town which lends itself to electric lighting; and he did not need to fear a loss to the Corporation on that score. As for his other argument—that the Company was in a too prosperous condition to sell at a reasonable price—his motion was originally proposed at a time when the Company's outlook was much more favourable than it is now. Coal was then cheap, and reductions in the price of gas were being announced all round. Now coal is dear; and the Chairman of the Company only the other week announced that he anticipated that next year an increase in the price of gas would be required. Public men too often do not seem to realize the position they should occupy in a transfer. When business is good with a gas company, they seem to imagine that then is the time for them to move, the actuating spirit being evidently one of covetousness; but when the gas company is in a period of depression, they "cold shoulder" the notion of seeking a transfer. The opposite should be their attitude. If a transfer be desired at all, it should, in the public interest, be sought when the gas company is in difficulties, and not when they are in the hey-day of prosperity.

It is with pleasure that I note the annual meeting of the Turriff Gas Company. Turriff is one of the small towns of Scotland possessing a gas-works which produce a high-class quality of gas—of course, at a high price. During the past year the Company increased their output; but what, to them, is of more importance, they reduced their leakage by 1½ per cent. from what it was the previous year, and by 4½ per cent. from what it was two years ago. The Company are content with a small dividend—only 5 per cent.—which they paid this time as in former years; and they did not require to raise the price of gas. I take this Company as an illustration that enlightened management may be made to pay even in small towns.

I feel surprise at Bailie Archibald having agreed with so little pressure to withdraw his resignation of the office of Convener of the Works Committee of the Edinburgh and District Water Trust. In a letter to the Clerk to the Trust, written on Monday, he said: "I have now given careful consideration to the resolution which the Trustees have done me the honour to agree to unanimously, that I should withdraw my resignation as Convener of the Works Committee; and accepting this as an expression of the confidence of the Trustees, I feel it my duty to accede to their request, and hereby withdraw my letter of resignation." I thought he would have stood out till, at all events, the municipal elections were over; and that then, there being no doubt that the ratepayers will ratify the proposals of the Water Trust, he could have come back victorious to his office. Probably he saw that the adverse vote which he experienced in the Trust did not proceed from the conviction of the Trustees, but was only an electioneering move; and that in a spirit of forgiveness he has agreed to forget the vote, knowing that his course will be cleared of all obstacles when the citizens of Edinburgh have agreed upon who is to be their Lord Provost. If anything would help him to perceive that this was the situation, it would be that his temporary successor in the convernership (Bailie Dunlop), who was the prime mover in the opposition to him, was even more energetic than himself in pushing forward the arrangements for proceeding with the Manor scheme of augmentation. These arrangements are, of course, being carried out quietly; but I understand that a large number of men are at work in the Manor valley, in the employment of the Trust, by which a large outlay is being incurred in the promotion of a scheme to which the Trustees made believe they wished the sanction of the ratepayers before going any further with it. A rumour has been set afloat that the Corporation of Peebles are about to promote a Bill in Parliament next session for the appropriation of the Manor valley, with the intention of excluding the Edinburgh Trust, who cannot now be in Parliament till next year. I hardly think it has much foundation, however; because the leading men of Peebles are convinced that with the safeguards as to their supply which the Trust offer, they would be better off if Edinburgh were to be successful than they are at present, in respect that they would then get a supply of pure water from the reservoir of the Trust, whereas at present, taking their water direct from the stream, they are troubled with turbidity whenever a flood occurs. The Leith Town Council with commendable promptitude, have already had the question before them, and have, by a large majority, approved of the Manor scheme; but of course their resolution is liable to be upset by the electors at the beginning of November, though that is a very remote probability.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

The municipal election meetings are now getting into full swing in Glasgow and other towns in the West of Scotland; and where members of Town Councils are giving accounts of their stewardship, they are also in some instances dealing prominently with gas matters. One such instance occurred on Tuesday evening at Kilmarnock, on which occasion Bailie Lawson, the Convener of the Corporation Gas Committee, delivered himself of some interesting statements. He remarked that the profits for the year ending June last were somewhere about £2000; while in the course of the year they paid off about £4500 of bonds—the largest sum ever paid off in any single year up till now. The funds were accumulating again, and there was a very good prospect that some more would be paid off by another year; and the fact remained that in two years from now they would get another reduction in the price of gas. They had made a new departure in the course of the year—the introduction of gas-stoves and gas-fires. This was done both for the purpose of enabling the community to get stoves and fires, which had been found to be such a benefit in other towns, and also with the view of increasing the consumption of gas in the summer months. While there was plenty of power in the works to make the gas, there were not sufficient facilities for disposing of it. The experiment had been highly satisfactory, because, since June, the extra consumption, compared with last year, was one-and-a-half million cubic feet; and the Manager had informed the Gas Committee that at least one million cubic feet of this could be put down to the gas appliances spoken of. Dean of Guild Paterson, who is also a member of the Gas Committee, said he was strongly in favour of the gas-stoves being brought into requisition and from the report which they had received, it appeared that they had been the means of greatly increasing the consumption of gas.

At Greenock last night, the electors of the Sixth Ward had their meeting with their representatives in the Town Council and Police Board. Councillor Mitchell, one of the representatives of the ward, a gentleman who takes a very decided interest in the town's gas supply undertaking, remarked that a few months ago he saw a statement in the public press to the effect that there was 4s. 3d. of taxation on every pound of rental in Greenock. If this was correct—and in addition they had to pay 7d. per 1000 cubic feet more for gas than was paid in Paisley, and 10d. per 1000 feet more than was paid in Glasgow—there was, he said, little wonder that they heard such grumbling among a large number of people. They were told that the gas question was one fraught with a great amount of difficulty, and that it would be dangerous to reduce the price of gas to too low a figure—a statement which he was not prepared to dispute. The only difficulty which he had in the matter was to know when the price of such a commodity as gas could be at too low a figure. After stating that he had been able to show at a recent meeting of the Police Board that the price of gas could be reduced, and to the advantage of the community, Mr. Mitchell said that in some quarters they were told that if they had a large surplus from the gas profits each year, the police rate would be up 1d. or 2d. per pound, which would just be the same thing. But he was not going to jump at that conclusion without some consideration; and from inquiries which he had made, he was satisfied that a sum of £2041, which was the amount of the gas profits last year, would be better distributed, and more equitably raised, by police assessment on the whole community. Councillor Cook also dealt with gas affairs at the same ward meeting. He said that the large gas profits that were annually made had enabled the Police Board to keep down the already large taxation. For last year the profits amounted to £2040; and the estimated profits for this year were put down at £1400, which he trusted would be more than realized. But they must take into account the fact of an advance of 2s. 6d. per ton on the cost of the gas coal; and hence it was estimated that the total cost of coal for the current year would be over £2000 in excess of that of last year. As they were aware, Councillor Mitchell tabled a motion which had been duly discussed and voted upon at the Police Board, for the purpose of reducing the price of gas to consumers by 2½d. per 1000 feet. He (Mr. Cook) was present at the meeting, but had to leave before the vote was taken. Had he remained, however, he would have been compelled to vote against the motion, if it were only because of the large increase in the cost of gas coal and the deficit in the Board's finances of over £600; for he believed that had Mr. Mitchell's motion been successful, it would have necessitated an addition of one penny to the police rates. When the "heckling" came on, Mr. Cook was asked if he would support Mr. Mitchell in the event of that gentleman again bringing forward his motion in regard to a reduction in the price of gas. He replied that he would, provided that they did not require to add another penny to the rates; but he could not think of it otherwise, as they would merely be taking money out of one pocket and putting it into another. Another very important question put to Mr. Cook was, Why should gas consumers be called upon to pay the rates of those who consumed no gas at all? He admitted that to be a very pertinent question; but there was, he said, a more pertinent one started during the discussion on the gas question. It was stated that there were manufacturers using the electric light who had been previously using gas. He made inquiries regarding this matter, and found that a company were making their own gas in one case, and that a company in another case were not only making their own gas, but were supplying gas to others. The questioner would not admit that to be an explanation, and he held Mr. Cook to the point. Mr. Cook replied that he was quite willing that the price of gas should be lowered. It would be a boon to himself,

and he would be as glad as any other ratepayer if the price were reduced; but still he was of opinion that they should not do this at the expense of raising the rates.

At the last meeting of the Lockerbie Police Commissioners, it was resolved to impose a rate of 1d. per pound of rental under the Burghs Gas Supply (Scotland) Act, in order to meet an estimated deficiency of £38 odd, rather than raise the price of gas at this time. Since the passing and first adoption of the Gas Act, there has not been such a case as this. In no instance have the gas-rates ever been subsidized for a general police rate.

This week has been a very uninteresting one in the Glasgow pig-iron market. Business has been almost entirely in Cleveland and hematite iron; but the amount of dealing has been very limited. Yesterday's closing prices were: Scotch iron, 47s. per ton cash buyers; Cleveland, 40s. 5d.; hematite iron, 49s. 4d. per ton.

The coal trade has been somewhat quieter this week. It is not expected that any material change of prices will be made between this time and the spring of next year. Main coal is quoted at 8s. to 8s. 2d. per ton free on board; ell coal, at 9s. to 9s. 9d. per ton; best ell dross, at 4s. 6d. to 5s. per ton; and best house sorts, at 10s. to 13s. per ton at the pits. Splint coal maintains a firm front at 9s. 3d.; and steam coal, at 10s. to 10s. 6d. per ton.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 17.

Sulphate of Ammonia.—The market has a somewhat steadier appearance; and notwithstanding the still unfavourable reports and low quotations emanating from the dealers, makers have been able to realize better prices. Closing values are £10 11s. 3d. to £10 12s. 6d. f.o.b. Hull and Liverpool; and £10 10s. f.o.b. Leith. There is considerable inquiry for forward delivery; but makers seem to have made up their minds not to contract further at present. Nitrate is firmer; and the position is favourable. The total shipments during the first nine months of this year do not exceed 350,000 tons, against 475,000 tons during the same period last year; and it appears doubtful whether the guaranteed maximum of shipments will now be reached this year. It is also contemplated to suspend steamer shipments during January and February next, a circumstance which ought to affect the market favourably. The spot price is 9s. 1½d. per. cwt Cargoes October-November shipment are worth 9s. 6d. to 9s. 7½d.

LONDON, *Oct.* 17.

Tar Products.—With the exception of pitch, which is still in good request, all the other tar products remain in a lifeless condition. Little new business is being done; but makers are evidently busy, for there are heavy shipments taking place in all directions. If it were not for the considerable outlet which exists for tar oils for illuminating purposes, distillers would be seriously inconvenienced with them at present, as the demand is falling off for its ordinary use somewhat remarkably. Prices obtaining during the week are: Tar, 23s. to 25s. Pitch, 33s. 6d. to 35s. Benzol, 90's, 3s. 7d.; 50's, 2s. 6d. Toluol, 1s. 4d. Solvent naphtha, 1s. 4d. Crude naphtha, 1s. 1d. Creosote, 1½d. Carbolic crystals, 6d.; crude, 60's, 1s. 1½d. Cresol, 7½d. Anthracene, "A" quality, 1s. 2d.; "B," 10d.

Sulphate of Ammonia.—This market is flat; and the price does not improve. Curiously, stocks are low; but makers appear anxious to sell. Considerable business is reported at prices ranging from £10 5s. to £10 8s. 9d., less the usual discount. Gas liquor is selling at 4s. to 5s.

THE LANCASHIRE GAS COAL TRADE.

From Our Own Correspondent.

Business in the coal trade of this district is moving on very steadily, so far as the demand for all house fire descriptions is concerned; and prices are being fully maintained at late rates—best Wigan Arley coal readily fetching from 12s. 6d. to 13s.; Pemberton 4 feet, and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton. Apart, however, from house-fire coals, there is still an absence of any pressure of demand in the market; but as there is an increasing probability of a scarcity in the better descriptions of round coal as the winter progresses, this will necessarily have a hardening effect upon the lower qualities. For steam and forge purposes, the demand is but moderate; and in many cases prices are only being maintained with difficulty—good qualities of steam and forge coal not averaging more than 8s. to 8s. 6d. per ton at the pit mouth. Supplies of engine classes of fuel continue far in excess of requirements; and the commoner qualities of slack are still a general drug upon the market, with sales pushed at excessively low figures, whilst contracts for next year are being readily accepted at fully 1s. to 1s. 3d. per ton below previous prices. At the pit mouth burgy does not average more than 6s. 6d. to 7s.; the better qualities of slack may be bought at 5s. to 5s. 6d.; with common sorts averaging about 3s. per ton at the pit mouth. For shipment there is a fair demand; and steam coal remains at about 9s. 6d. to 10s. per ton delivered at the ports on the Mersey. The agitation amongst the men with regard to wages, referred to last week, has been followed by a strike at one of Messrs. Andrew Knowles and Sons' collieries, where the miners are making a claim to be paid for "packing," which it is contended has hitherto been included in the price per yard allowed for getting the coal.

Northern Coal Trade.—The dulness in the coal trade has been increased by the stormy weather, which has delayed the arrival of steamers. In consequence, in some instances, steam coal has been sold at lower prices to secure full work for the collieries. As low as 11s. per ton, free on board, has been accepted for best steam coal; but with the arrival of vessels, rather better prices prevail, and from 11s. 3d. to 11s. 6d. per ton may be looked upon as the current quotations. Small steam coal is about 4s. per ton. Gas coal now, naturally, finds an increasing demand; and deliveries, both locally and for shipment, are large as compared with what they were seven or eight weeks ago. They will still increase for about two months; but the inquiry for the Baltic will fall off. The price of best Durham gas coals is about 9s. 6d. per ton, free on board; but contracts are both at higher and lower rates. Bunker coals are very dull; being in limited request, and the supply increased by the considerable amount of small steam as well as of soft Durham coal that is thrown into the market. Household coal is only dull; and manufacturing coal is quiet. Blast-furnace coke is steadier; orders from the north-western furnaces being larger, whilst there is also a greater demand from the Cleveland furnaces. There is no alteration in gas coke, though the contracts for next year are expected to be soon decided at lower prices.

Water Supply and Sewerage Works for Melbourne.—The Melbourne Metropolitan Board of Works are about to raise a loan of £2,000,000, on the London market, at 4 per cent.; the money to be devoted to sewerage works and the provision of an additional water supply. The bonds will be redeemable in 30 years.

Gas Exhibition at Kingstown.—The Alliance and Dublin Gas Company, being so pleased with the success which attended Messrs. Richmond and Co.'s exhibition in Dublin, decided to try a similar experiment in their outside districts, under the direction of that firm. Cookery lectures were given by Miss Thwaites, of Liverpool; and the exhibition was superintended by Mr. W. J. Sugg, the Manager of the Gas Company's stove and gas-engine department. Here again, the attendance has been so satisfactory that an extension of time has been decided upon.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold some shares in the *Slough Water-Works Company* (£9 8s. paid) at £10 5s. to £10 10s. each; fully-paid £10 shares in the *Leatherhead and District Water Company*, at £8 each; and some £100 debentures of the *Woking and District Water and Gas Company* at par. On the following day, Messrs. Tootell and Sons sold some £50 lots of stock of the *Maidstone Gas Company* at £110 to £115 each; and several £25 lots, at £52 to £53 each. On the same occasion, a parcel of stock of the nominal value of £75 realized £150.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 706.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17*	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	11¼—12¼*	+¼	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	28 May	8	Bahia, Limited	20	13—15	..	10 13 4
200,000	5	13 May	7½	Bombay, Limited	5	6¾—7¼	..	5 3 5
40,000	5	,,	7½	Do. New	4	4¾—5¼	..	5 14 1
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	215—225	−½	5 8 10
125,000	,,	,,	9½	Do. New	100	157—162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original	20	40—42	..	5 9 6
444,250	Stck.	16 Sept.	10	Bristol.	100	208—213	..	4 13 11
320,000	20	15 Oct.	11½	British.	20	44—46*	..	4 17 10
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18—20	..	5 15 0
50,380	10	,,	8½	Do. 7 p. c.	10	13—15	..	5 13 4
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	7—8	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	90—95	..	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24—26	..	6 3 1
550,000	Stck.	15 Oct.	13¾	Commercial, Old Stock	100	235—245*	−8	5 12 3
161,396	,,	,,	10¾	Do. New do.	100	185—195*	+8	5 10 3
130,000	,,	26 June	4½	Do. 4½ p. c. Deb. do.	100	119—124	..	3 12 7
800,000	Stck.	11 June	10	Continental Union, Limited	100	225—235	−5	4 5 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	100	190—200	..	3 10 0
75,000	Stck.	16 Sept.	10	Crystal Palace District	100	190—200	−4½	5 0 0
486,090	10	15 July	10	European, Limited	10	20—21	..	4 15 3
354,060	10	,,	10	Do. Partly paid	7½	14¾—15¾	..	4 16 9
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	205—215	−16½	6 0 11
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	251—256	−2	3 18 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	118—123	..	4 1 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	172—177	..	4 4 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	155—160	−4	4 7 6
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	250—255	..	3 18 5
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	145—155	−4½	3 17 5
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	100	112—115	..	3 9 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	120—125	..	3 12 4
908,000	,,	,,	6	Do. 6 p. c. do	100	163—168	..	3 11 5
3,800,000	Stck.	13 May.	12	Imperial Continental	100	218—223	−6	5 7 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4¼—4¾	..	6 6 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	11 June	6¾	Monte Video, Limited.	20	16¾—17¾	..	7 8 6
150,000	5	28 May	10	Oriental, Limited	5	8¼—8¾	..	5 14 3
60,000	5	30 Sept.	7	Ottoman, Limited	10	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited.	10	2¾—3¼	..	—
				People's Gas of Chicago—				
420,000	100	4 May	6	1st Mtg. Bds.	100	92—97	..	6 3 9
500,000	100	1 June	16	2nd Do.	100	90—95	..	6 6 4
150,000	10	15 Oct.	10	San Paulo, Limited	10	13¾—14¾*	+¼	6 18 0
500,000	Stck.	28 Aug.	15½	South Metropolitan, A Stock	100	255—265	−10	5 17 0
1,350,000	,,	,,	12	Do. B do.	100	215—225	−2½	5 6 8
200,000	,,	,,	13	Do. C do.	100	225—235	−5	5 10 8
700,000	,,	26 June	5	Do. 5 p. c. Deb. Stk.	100	141—145	..	3 9 0
600,000	Stck.	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,281	Stck.	26 June	10	Chelsea, Ordinary	100	265—270	..	3 14 1
1,720,560	Stck.	15 Oct.	8	East London, Ordinary	100	208—210*	−1	3 16 3
544,440	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	138—143	..	3 3 0
700,000	50	11 June	8	Grand Junction	50	109—113	..	3 11 9
708,000	Stck.	13 Aug	10½	Kent	100	265—275	−5	3 16 4
1,043,800	100	26 June	9½	Lambeth, 10 p. c. max.	100	237—242	..	3 18 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	193—198	..	3 15 9
260,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	118—121	..	3 6 1
500,000	100	13 Aug.	12½	New River, New Shares	100	341—346	..	3 10 1
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	123—126	..	3 3 6
902,300	Stck.	11 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	165—170	..	3 16 5
126,500	100	,,	6½	Do. 7½ p. c. do.	100	160—165	..	3 18 9
1,155,066	Stck.	11 June	10	West Middlesex.	100	253—258	−2	3 17 6

*Ex div.

Messrs. Willey and Co., of Exeter, have changed their London address to No. 12, St. Helen's Place, E.C.

Monte Video Water-Works Company, Limited.—The Directors of this Company have declared an interim dividend of 2½ per cent. for the half year ending June 30 last.

Fatality at the Derby Gas-Works.—Last Friday week, a labourer named Arnold Bird, aged 29, met with his death through the falling of a brick down a chimney in which he was employed at the Derby Gas-Works. A coroner's inquiry into the matter was held last Wednesday; and the jury returned a verdict of "Accidental Death."

The Sewage Question at Cambridge.—The Cambridge Town Council have adopted the scheme of Mr. T. Wood, of Liverpool, for the re-drainage of the borough. The scheme of collection is estimated to cost approximately £100,000. To this is to be added, as soon as the Corporation arrive at a decision, the cost of the purification or utilization of the sewage.

Extensions at the Lewes Water-Works.—In consequence of the increase of business, the Directors of the Lewes Water Company have decided to put up new and more powerful machinery. Messrs. Easton and Anderson have secured the contract for the engineering work; and the tender of a local contractor (Mr. W. Wells) has been accepted for the necessary buildings.

Electric Lighting for Helston.—Last Wednesday the Helston Town Council had a special meeting, for the purpose of considering the advisability of applying for a Provisional Order, authorizing them to supply electric lighting for public and private purposes. A long report was submitted by the Chairman of the Special Lighting Committee (Mr. R. Cade), embodying a scheme which it was estimated would cost £2600. The total annual expense was computed at £226; and the Committee considered that, after supplying private consumers there would be a profit to the ratepayers on the undertaking. Mr. Cade moved that the Council should make application for a Provisional Order; and, this having been seconded, a long discussion ensued. In the course thereof, the Mayor (Mr. R. S. Martyn) stated that the Gas Company had offered to light the public streets for £184 per annum, subject to a deduction of 7½ per cent. The motion was ultimately carried by seven votes to three. At the close of the proceedings, an informal public meeting was held, at which a resolution was passed, protesting against the action of the Council, and pledging those present to do all in their power to resist the electric lighting.

Fylde Water-Works Company.—The report and balance-sheet of this Company for the past six months have been issued. It appears therefrom that the capital account is increased by an expenditure of £10,863; making it now £268,014. The number of consumers is 11,082. A dividend of 10 per cent. has been declared on the "A" stock; and 7 per cent. on the "B" stock. This leaves a balance of £4 10s. to be carried forward. The new 15-inch main from Weeton to Blackpool is now laid. Through the opposition of the Corporation of Blackpool, and the local authorities of Lytham, St. Anne's, and Fleetwood to the Company's Bill in Parliament, that part of section 40 of the Fylde Water-Works Act, 1861, authorizing public-houses and lodging-houses to be charged one-third more water-rate was repealed; thus conferring an immediate advantage on the tenants of this class of property, where an excessive quantity of water is consumed during the summer months, but resulting to the future disadvantage of all other classes of property, which constitute a very large majority of the consumers of the water. Notwithstanding the extravagant opposition in Parliament, the Bill for acquiring the whole of the water in the River Calder received the Royal Assent on July 3. Tenders have been advertised for; and the new water will be available for next summer.

The Dangers of Paraffin Lamps.—Last Tuesday, the Liverpool Coroner investigated the circumstances attending the deaths of the man Brown and his son and infant daughter, which occurred at a fire in the city on the 10th inst., as already recorded in the JOURNAL (*ante*, p. 679). It was shown that the fire was caused by the explosion of a paraffin lamp, and that both man and boy died from the effects of burns and shock. The death of the infant was the result of fright; the mother having, in her excitement, thrown it from an upper window into the arms of a man outside, and then leapt into the street, sustaining a fracture of the ribs and a sprained ankle. An open verdict was returned. Last Wednesday, Mr. S. F. Langham, the City Coroner, held an inquiry at St. Bartholomew's Hospital respecting the death of Augustus Edwin Cleal, aged two years and nine months, the son of a French polisher, residing at 122, John's Road, Hoxton, who was burnt to death through the upsetting of a paraffin lamp on the previous Sunday evening. Henry Cleal, the father, who appeared in Court with his hands and arms severely burnt, deposed that at dusk on the evening in question, his wife refilled the paraffin lamp (a common one, with a glass reservoir), and placed it on the table. Deceased and his sister were playing in the parlour; and, while doing so, the child slipped, and in falling caught hold of the table-cloth. The lamp was upset; and the reservoir and glass broke, letting out the oil, which became ignited, and enveloped him in flames. The child was removed to the hospital, but succumbed to his injuries a few hours later. The Coroner said there was always a certain amount of danger in the use of paraffin lamps, but it was reduced to a minimum if lamps which were fitted with metal reservoirs and self-extinguishing appliances were used. Such lamps as he had described were in the market, and only cost a small sum; so that they were within the reach of all. The jury returned a verdict of "Accidental death," and expressed an opinion that some restriction ought to be placed on the sale of lamps with glass reservoirs. At the meeting of the Court of Common Council of the City of London on Monday last week, it was resolved that the County Purposes Committee should consider and report on the state of the law in regard to lamps in general domestic use for the purposes of burning dangerous mineral oils; and that instruction should be given to the Committee to make suggestions to the Court thereon.

THE STORM.

During the recent terrifically heavy Gales, the whole of the "COLUMNLESS" Gasholders, erected under the patents of GADD & MASON (although, nearly in every case, fully inflated), withstood the pressure brought to bear upon them.

On the other hand, at least One Gasholder WITH COLUMNS was disabled; and, as a Consequence, the town was placed in total darkness.

The question naturally arises whether columns are not really AN ELEMENT OF DANGER, besides being a considerable additional cost.

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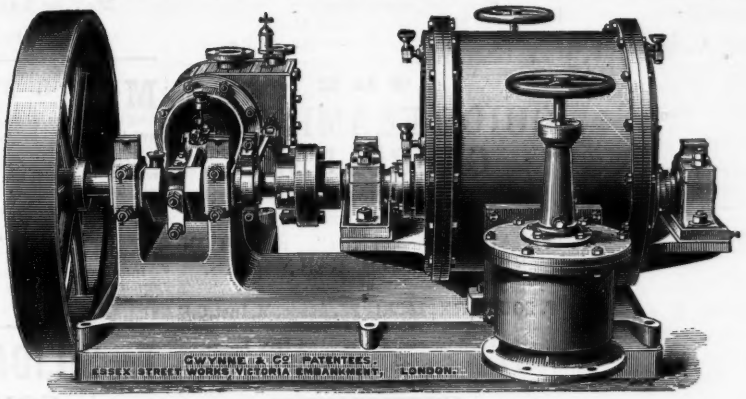
Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



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Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS AND PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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ANDREW STEPHENSON, Agent.
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WANTED, by a young Man (aged 20), a Situation as IMPROVER to Gas-Fitting, Main and Service laying. Can read Indices of Meters, &c. Served four years on a Gas-Works. Can have good reference.
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*** See Advertisement p. 730 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

MR. ALFRED KITT, Consulting Engineer, 5, VICTORIA STREET, WESTMINSTER, late Engineer of the Pimlico and Westminster Stations of The Gaslight and Coke Company.

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WANTED, by a young Man, an Engage- ment on a Tar-Works. Able to superintend the Distillation of Tar and the Manufacture of the Crude Products. Five years in one place; and three in last. Good references.
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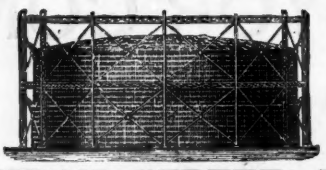

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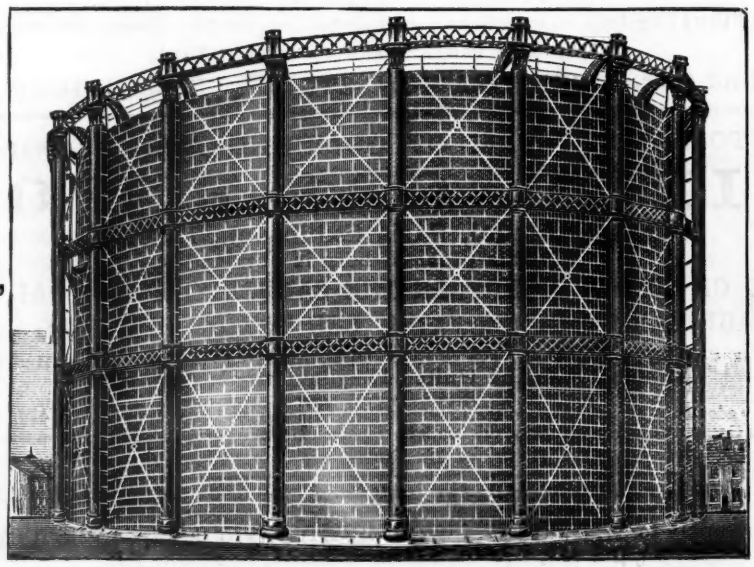

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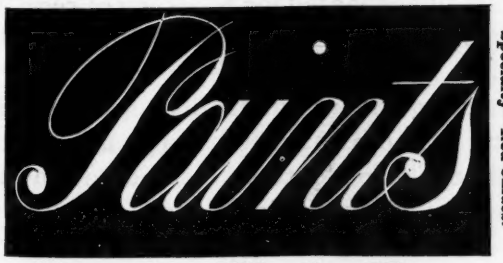

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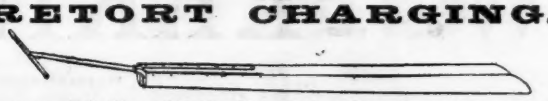

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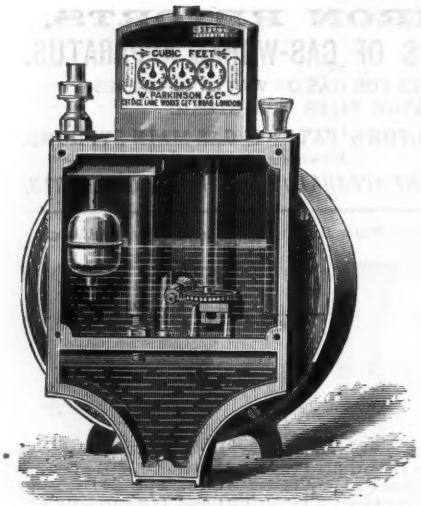

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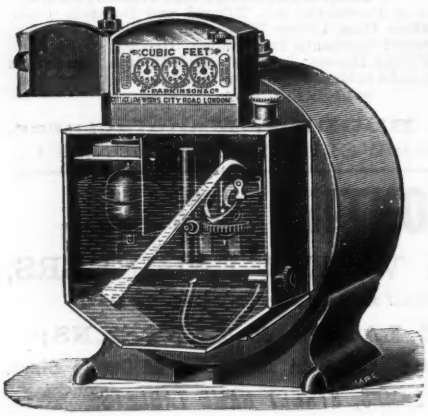

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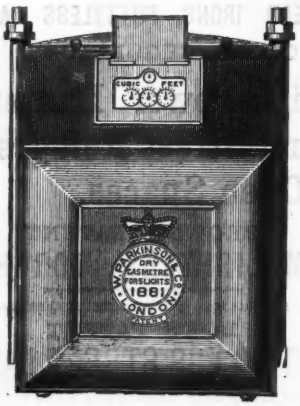

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[See also Advt., p. 702.

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